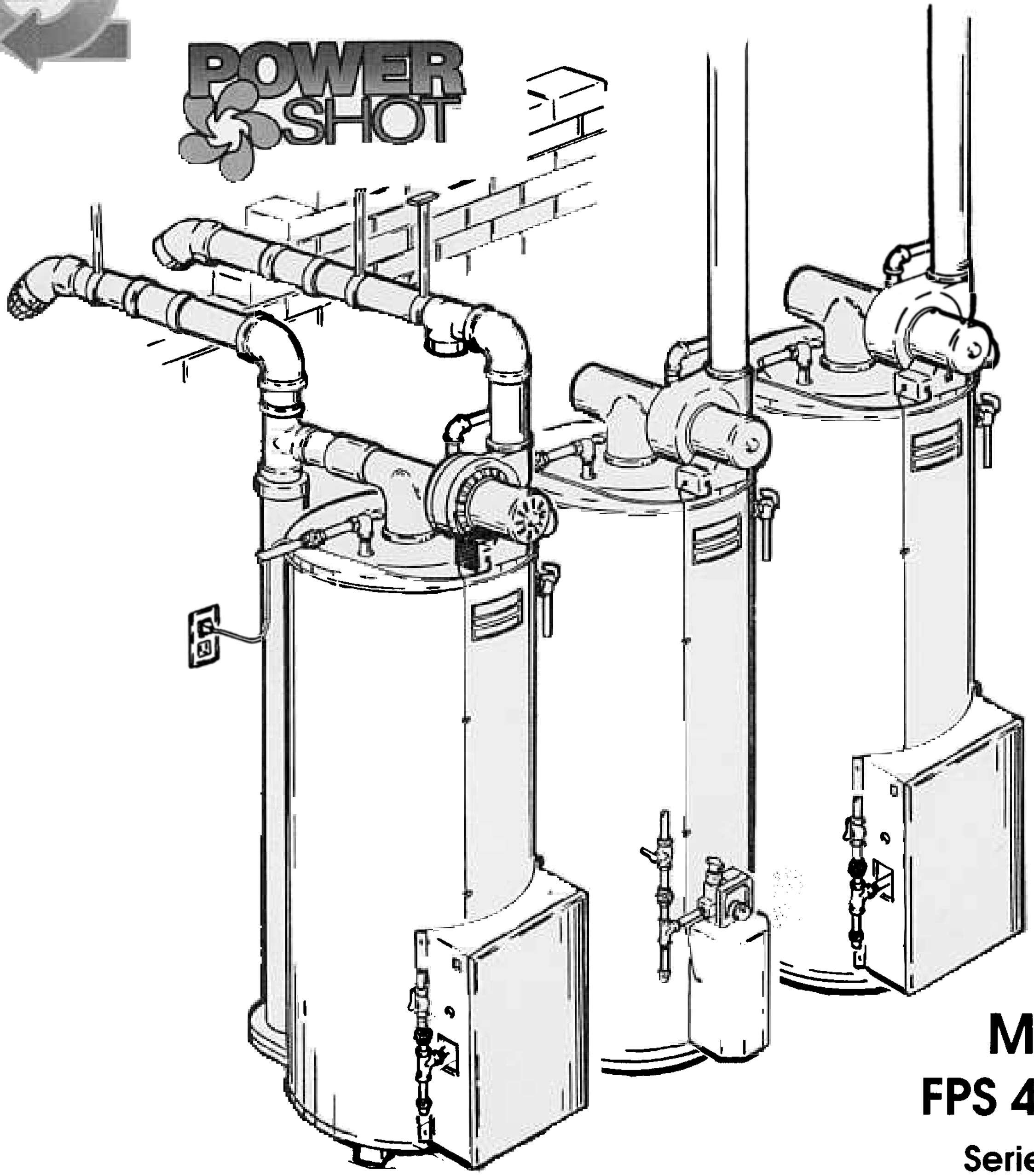
POWER VENT WATER HEATERS

Service Workbook



Models

FPS 40 and 50

Series 226-227

FPSE 40 and 50

Series 226E

FPD 40 and 50

Series 226-227

FPS 75

Series 230-233

Prepared by the
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A.O. SMITH
WATER PRODUCTS
COMPANY
A DIVISION OF A.O. SMITH CORPORATION

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WORKBOOK INTRODUCTION

Purpose	The information contained in this workbook is designed to answer situations commonly encountered in the operation of the POWER SHOT and SEALED SHOT Product and is not meant to be all inclusive. If you are experiencing a problem not covered in this workbook, please contact the A.O. Smith Technical Information Department at (800)527-1953 or your local A.O. Smith Water Products Company representative for further assistance. This workbook is intended for use by licensed plumbing professionals and reference should be made to the installation manual accompanying the product.

Model and Series Nos. Affected	This workbook covers the following models and series numbers. If your model is not listed, see other workbooks.

Model	Series	Model	Series
FPS 40 & 50 -	226 & 227	FPSE 40 & 50 -	226E
Model	**Series**	**Model**	**Series**
FPD 40 & 50 -	226 & 227	FPS 75 -	230 & 231
		FPS 75 -	232 & 233

Qualifications	Service of these water heaters must be performed by a qualified service professional. Gas supply, plumbing, air supply, venting and electrical work are required.

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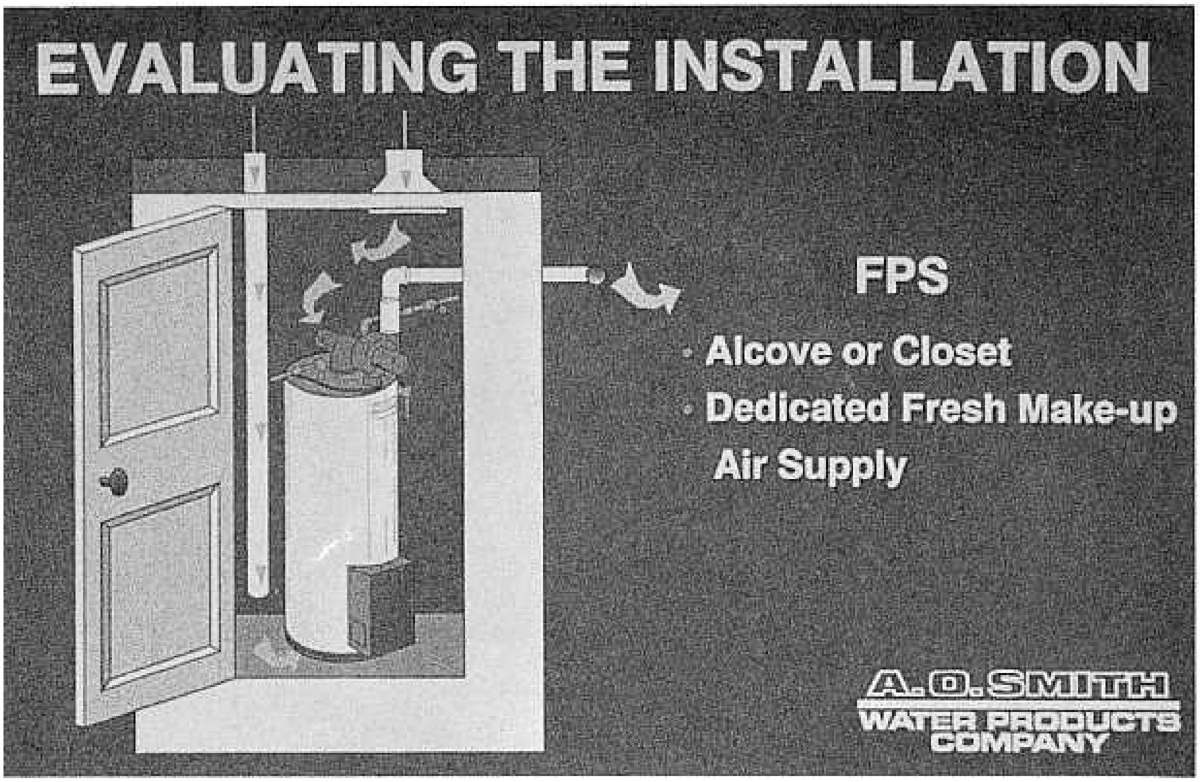
CHOOSING THE BEST WATER HEATER

Introduction: **FPS** **FPSE** **FPD**	The A.O. Smith power vent family of residential water heaters is designed to meet different installation conditions. Therefore we must evaluate the job site in which these heaters are to be installed.



EVALUATING THE INSTALLATION

FPS

- Alcove or Closet
- Dedicated Fresh Make-up Air Supply

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When to choose the: **FPS40 - 50**	The FPS40 - 50, Power Shot, is the best choice for those installations that need sidewall venting or complex vertical venting. It can be installed in an alcove, closet, or anywhere a source of fresh make-up air is available. Makeup air provides air for combustion and dilution air for venting. The FPS40 - 50 feature a standing pilot.

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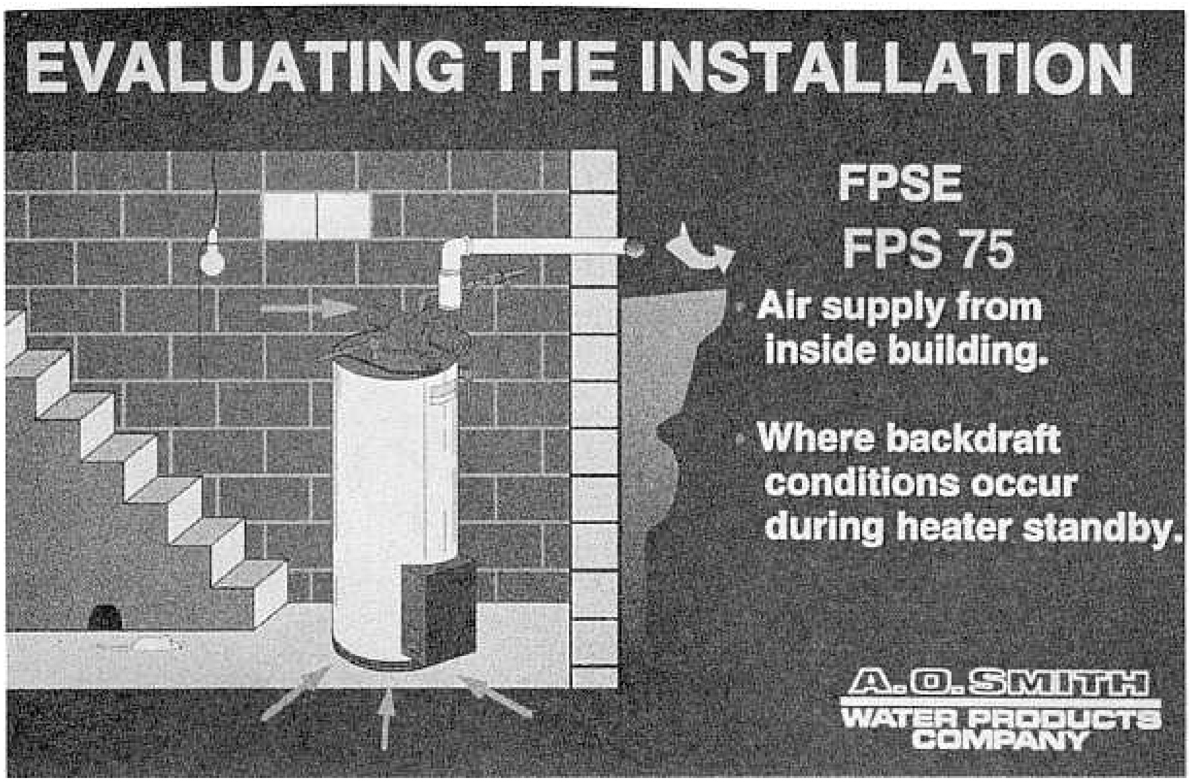
CHOOSING THE BEST WATER HEATER cont.



EVALUATING THE INSTALLATION

FPSE

FPS 75

- Air supply from inside building.
- Where backdraft conditions occur during heater standby.

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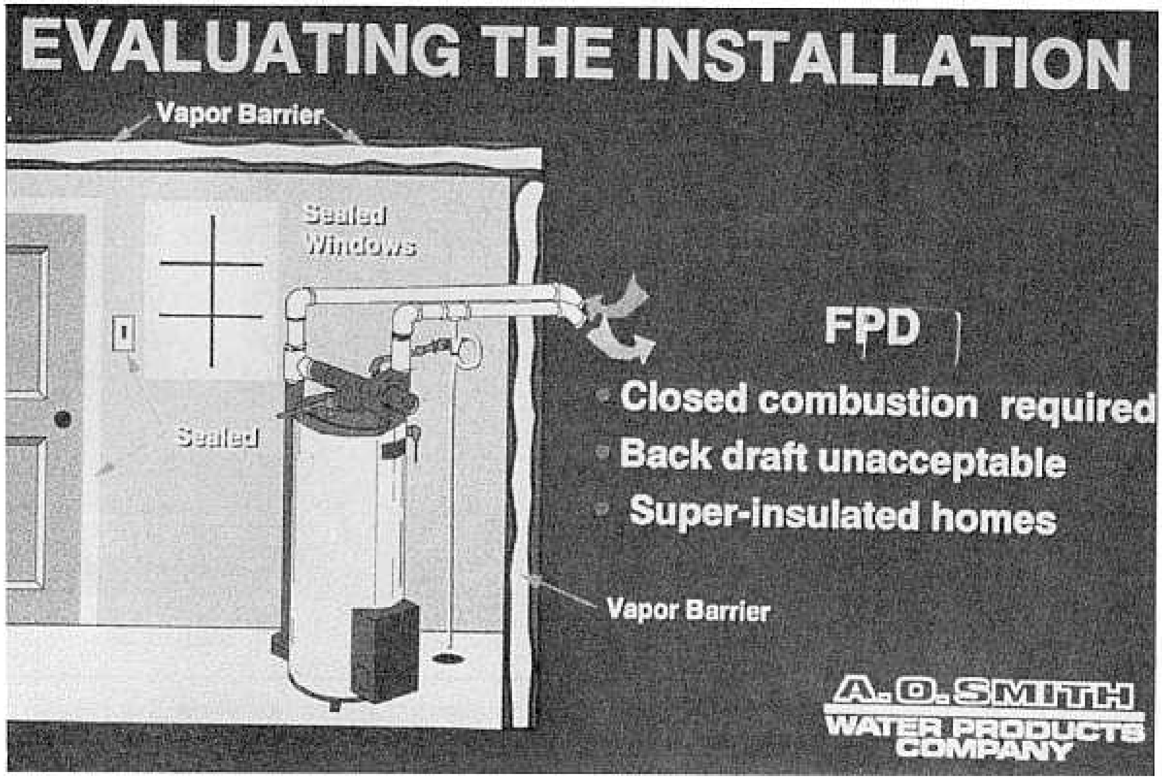
When to choose the: FPSE FPS75	Here the FPSE40 - 50 or FPS75, Power Shot, is the best choice for an installation where a negative pressure condition could develop from other appliance exhaust fans installed in the house. This illustration shows the heater in a large open basement. Air for combustion is drawn from inside the building, make up air is required. The FPSE and FPS75 use electronic spark ignition.

CHOOSING THE BEST WATER HEATER cont.



EVALUATING THE INSTALLATION

Vapor Barrier
Sealed Windows
Sealed
Vapor Barrier

FPD

- Closed combustion required
- Back draft unacceptable
- Super-insulated homes

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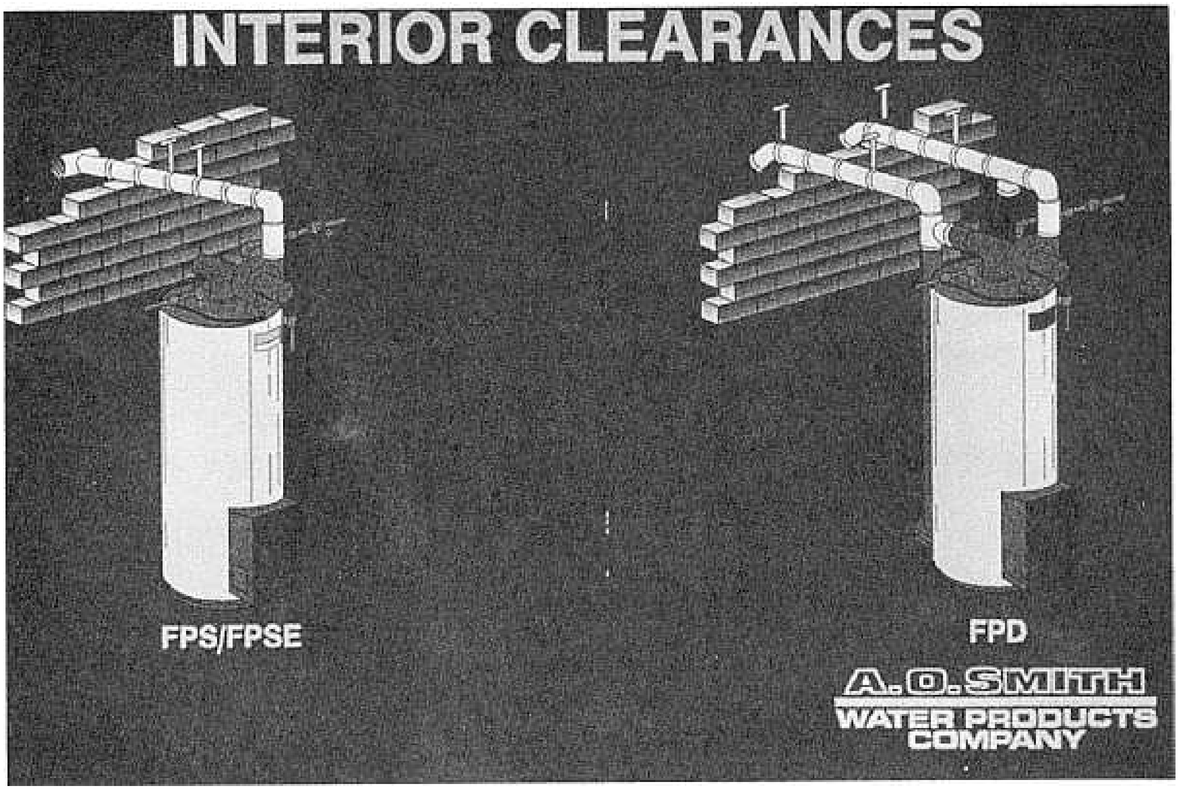
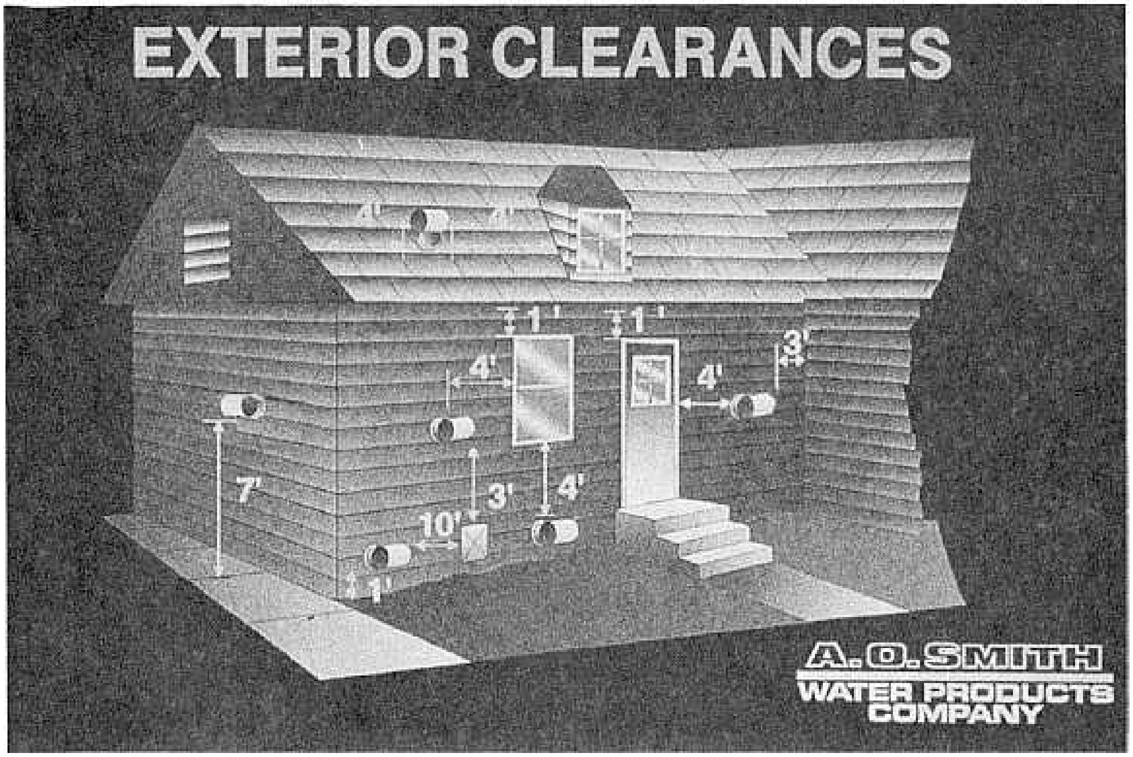
When to choose the: FPD	The FPD Sealed Shot with its own dedicated air vent and exhaust vent, is the heater of choice in installations where closed combustion is required - for example in living quarters. The FPD is recommended when installing a water heater in a super insulated energy efficient house, with sealed gaskets around the windows and doors.

VENTING INSTALLATION


INTERIOR CLEARANCES

Interior Clearances: **FPS** **FPSE** **FPD**	All interior clearance requirements indicate distances between the heater and combustible materials. Clearance of 0" is allowed from PVC vent to combustibles. Clearances allowed for the FPS40 - 50, FPSE40 - 50, and FPD40 - 50 are: Sides and rear - 0" Front - 4" Top - 21" Clearances allowed for the FPS75 are: Sides and rear - 2" Front - 6" Top - 24"

VENTING INSTALLATION cont.



Exterior Clearances:
FPS
FPSE

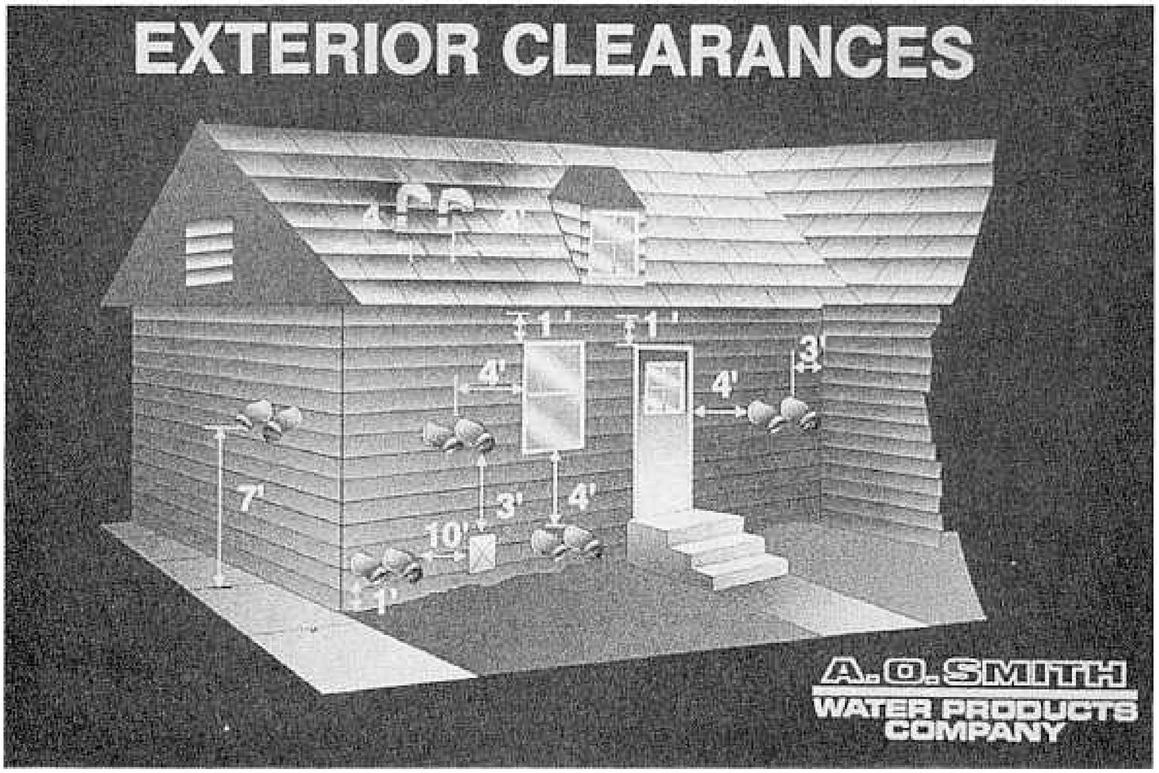
Exterior installation clearance requirements are crucial and must be met to ensure compliance with all safety and code requirements. If all clearances cannot be met, do not unpack the heater.

All exterior clearance requirements for the FPS and FPSE are measured from the vent termination.

Min. clearances for side wall venting:
- Inside corner - 3'
- Side of door or window - 4'
- Above door or window - 1'
- Below a window - 4'
- Above public walkway - 7'
- Above ground or snow level -1'
- Air intake to a living space - 3' above if air intake is within 10'

Min. clearances for vertical:
- 1' above or 4' to the side of any gable, dormer, or roof structure with building interior access.
- 1' above snow level.

VENTING INSTALLATION cont.



Exterior Clearances: FPD

Exterior installation clearance requirements are crucial and must be met to ensure compliance with all safety and code requirements. If all clearances cannot be met, do not unpack the heater.

All exterior clearance requirements for the FPD are measured from the vent termination.

Min. clearances for side wall venting:
- Inside corner - 3'
- Side of door or window - 9"
- Above door of window - 9"
- Above public walkway - 7'
- Above ground or snow level -1'
- Air intake to a living space - 3' above if air intake is within 10'

Min. clearances for vertical:
- 1' above or 4' to the side of any gable, dormer, roof structure with building interior access.
- 1' above snow level.

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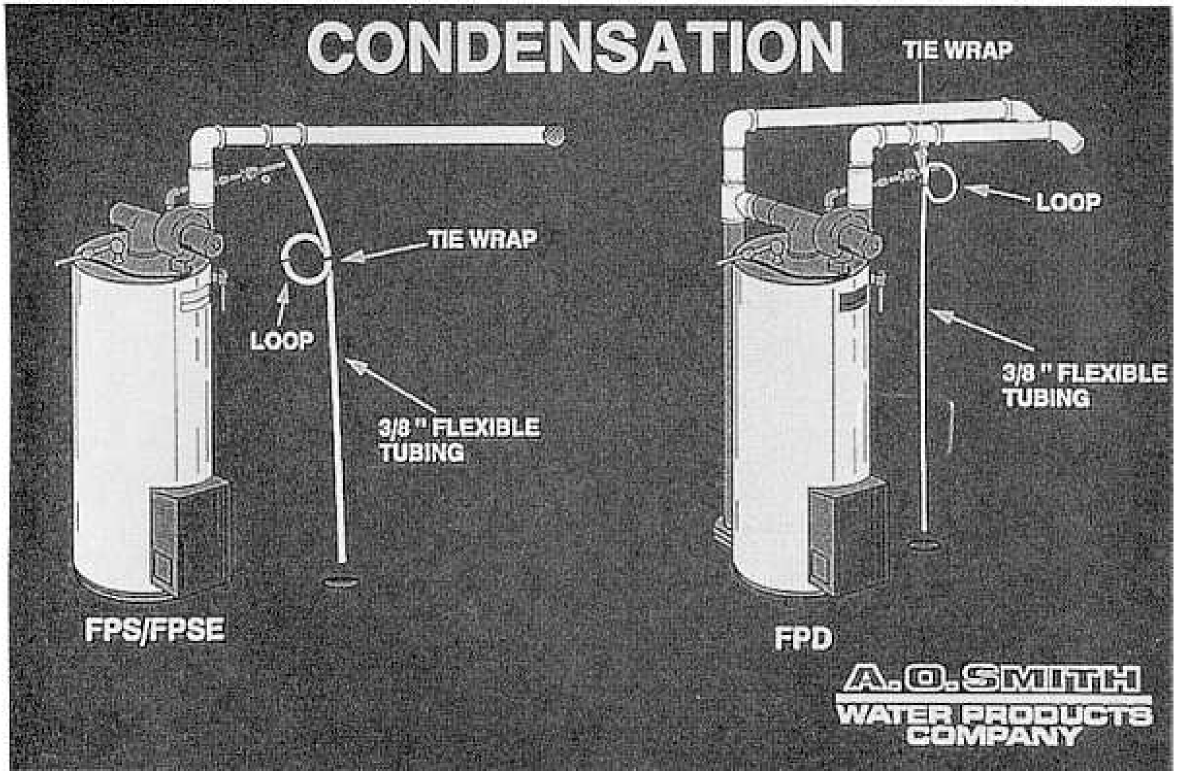
VENTING INSTALLATION cont.


CONDENSATION
TIE WRAP
TIE WRAP
LOOP
LOOP
3/8 " FLEXIBLE TUBING
3/8 " FLEXIBLE TUBING
FPS/FPSE
FPD
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Condensation: **FPS** **FPSE** **FPD**	In certain installations, you may experience condensation in the venting. This will be most prevalent in the colder climates and especially with relatively long runs of venting in unheated rooms. To prevent the damaging condensation from draining into the blower and/or water heater, install the condensate tee provided with the heater. It goes in the exhaust vent as close as possible after the blower elbow. Attach a 3/8" plastic tube for the drain as shown. Configure a loop in the tube at least 1' down from tee to prevent flue gases from escaping. Install the venting with a slight downward slope toward the termination end. This slope should be no more than 1/8" per 5 feet of horizontal run no more than 1" total max.

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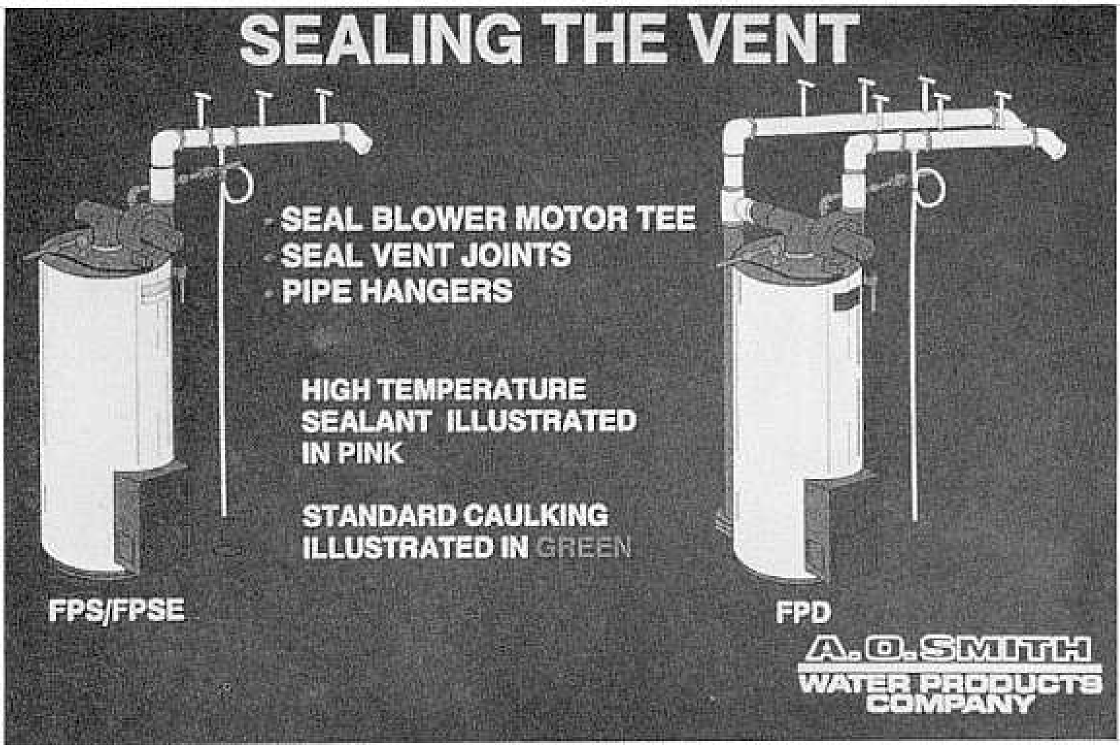
VENTING INSTALLATION cont.



SEALING THE VENT

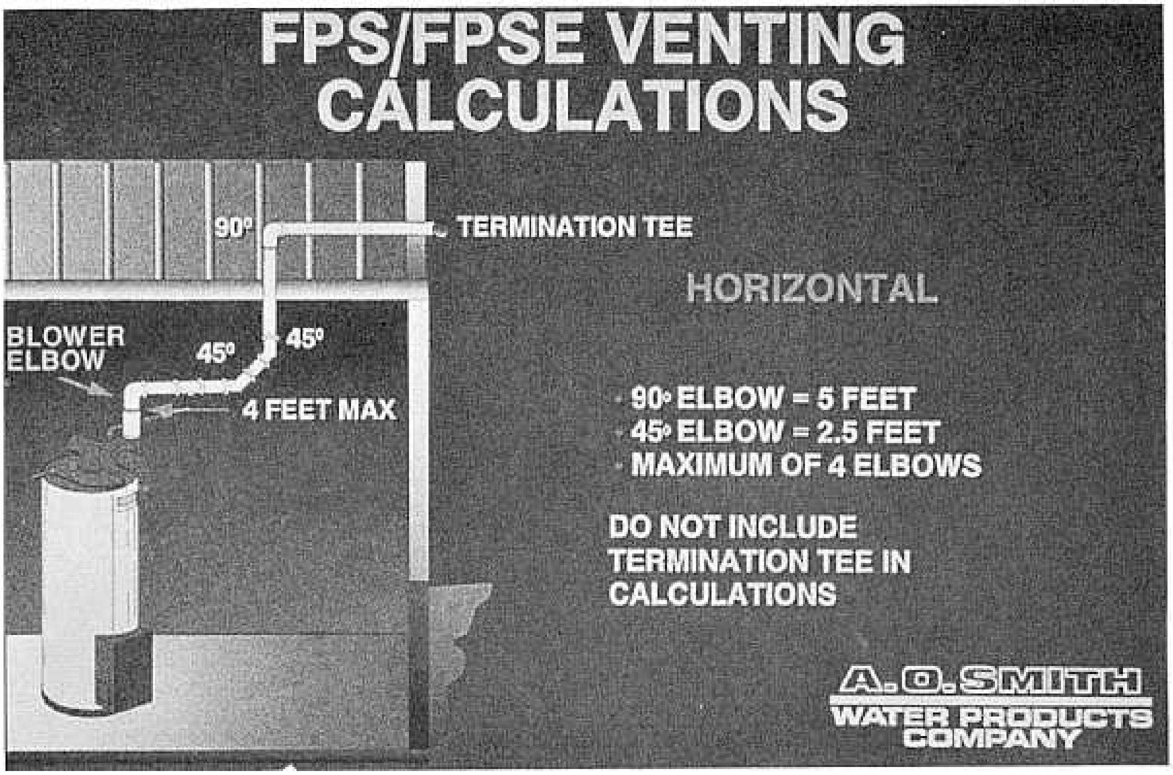
- SEAL BLOWER MOTOR TEE
- SEAL VENT JOINTS
- PIPE HANGERS

HIGH TEMPERATURE SEALANT ILLUSTRATED IN PINK

STANDARD CAULKING ILLUSTRATED IN GREEN

Sealing the Vent: **FPS** **FPSE** **FPD**	Proper sealing of the vent system is essential for correct operation of the heater. On the initial firing of the heater, check all joints in the system for a proper seal, especially where the blower motor joins the heater, and at the PVC vent pipe connects to the blower. If a blower joint leaks air, it should be caulked with the high temperature silicone sealant provided. Other joints may be sealed with standard caulking . The vent system should be supported every (3) feet of vertical run and every five (5) feet of horizontal run.

VENTING INSTALLATION cont.



FPS/FPSE VENTING CALCULATIONS

HORIZONTAL

- 90° ELBOW = 5 FEET
- 45° ELBOW = 2.5 FEET
- MAXIMUM OF 4 ELBOWS

DO NOT INCLUDE TERMINATION TEE IN CALCULATIONS

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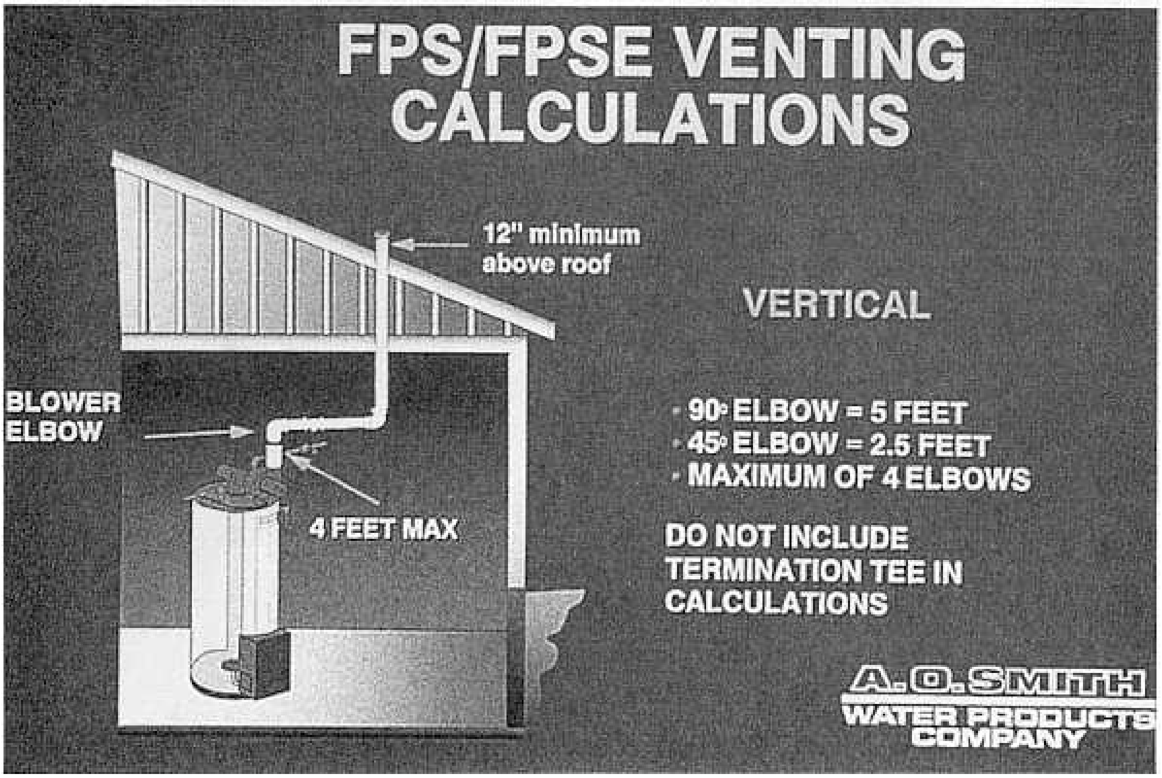
Horizontal Venting Calculations: **FPS** **FPSE**	As you can see, the FPS & FPSE40 - 50 models allow for increased venting flexibility. They can be vented horizontally up to a maximum of 45 equivalent feet from the heater. Do not include termination tee in calculations. FPS75 can be vented horizontally up to a maximum of 25 equivalent feet from the heater. Do not include the termination tee in calculations. Excluding the termination tee, you can have no more than four elbows in the vent system.

VENTING INSTALLATION cont.



FPS/FPSE VENTING CALCULATIONS

VERTICAL

- 90° ELBOW = 5 FEET
- 45° ELBOW = 2.5 FEET
- MAXIMUM OF 4 ELBOWS

DO NOT INCLUDE TERMINATION TEE IN CALCULATIONS

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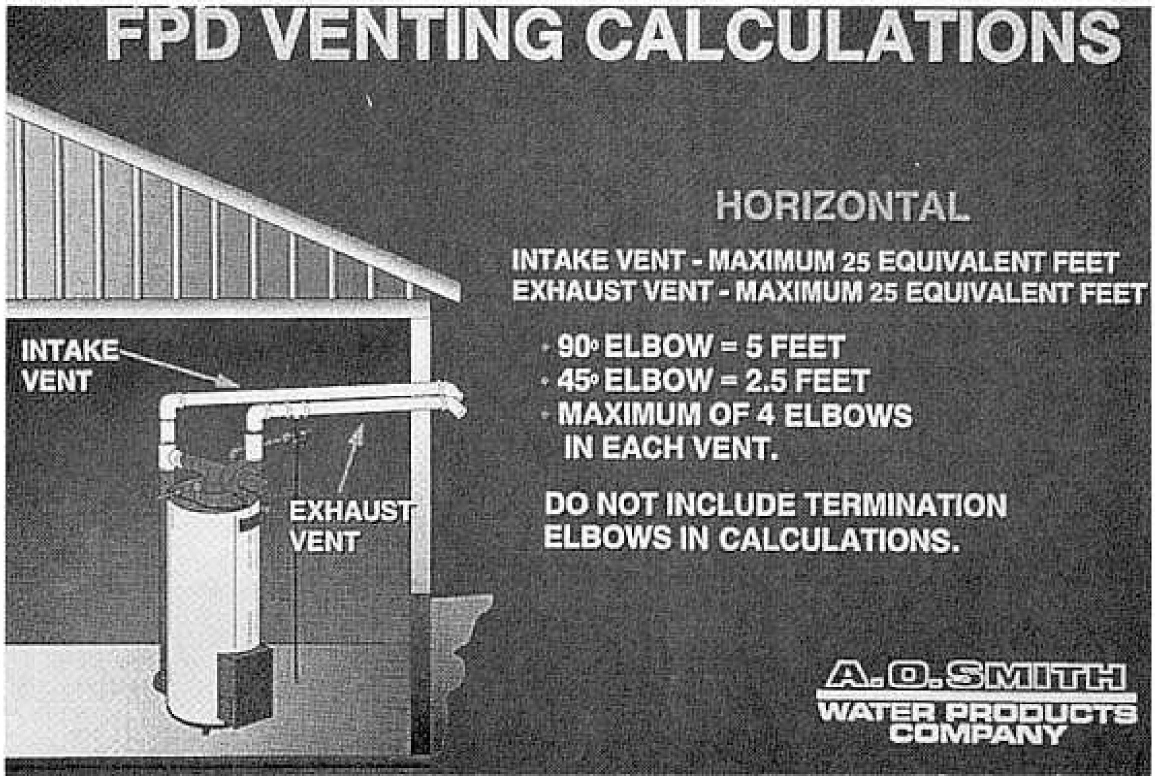
Vertical Venting Calculations: **FPS** **FPSE**	The FPS and FPSE40 - 50 can be vented vertically up to 35 equivalent feet from the heater. The FPS75 can be vented vertically up to 25 equivalent feet from the heater. A minimum of 1 foot must be maintained between to roof or anticipated snow level and the termination tee.

VENTING INSTALLATION cont.


INTAKE VENT
EXHAUST VENT
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FPD VENTING CALCULATIONS

HORIZONTAL

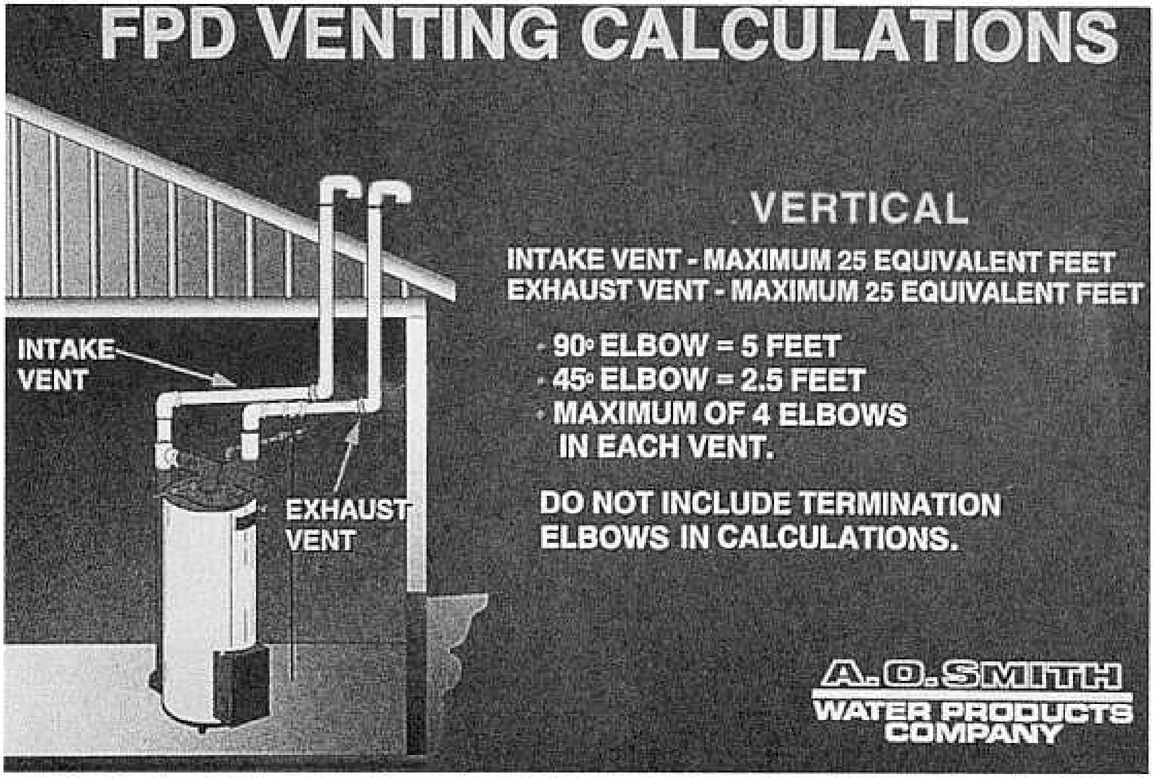
INTAKE VENT - MAXIMUM 25 EQUIVALENT FEET
EXHAUST VENT - MAXIMUM 25 EQUIVALENT FEET

- 90° ELBOW = 5 FEET
- 45° ELBOW = 2.5 FEET
- MAXIMUM OF 4 ELBOWS IN EACH VENT.

DO NOT INCLUDE TERMINATION ELBOWS IN CALCULATIONS.

Horizontal Venting Calculations: FPD	The FPD Sealed Shot features a two pipe system with a fresh air intake vent and an exhaust vent. Intake and exhaust elbows must be on same surface of the house. A maximum of 25 equivalent feet may be used in the intake vent system and a maximum of 25 equivalent feet may also be used in the exhaust vent. However, excluding the termination elbow, you can have no more than four elbows in each vent. Since improper venting is a chief cause of heater malfunction, careful planning and adherence to these venting requirements will minimize service calls and ensure proper operation.

VENTING INSTALLATION cont.



FPD VENTING CALCULATIONS

VERTICAL

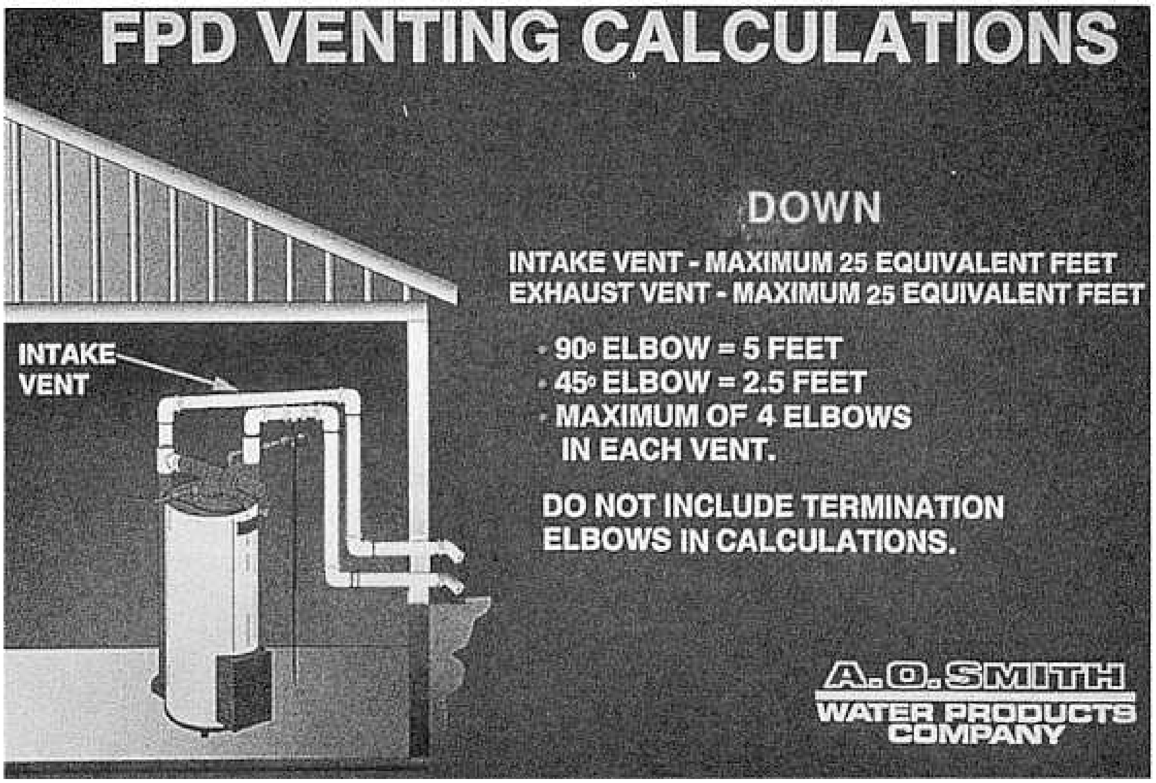
INTAKE VENT - MAXIMUM 25 EQUIVALENT FEET
EXHAUST VENT - MAXIMUM 25 EQUIVALENT FEET

- 90° ELBOW = 5 FEET
- 45° ELBOW = 2.5 FEET
- MAXIMUM OF 4 ELBOWS IN EACH VENT.

DO NOT INCLUDE TERMINATION ELBOWS IN CALCULATIONS.

Vertical Venting Calculations: FPD	This unit is approved for venting through the roof with only the terminations supplied with the unit. Intake and exhaust elbows must be on same surface of the house. Excluding the vent terminations, a maximum of 25 equivalent feet may be used in the intake vent system and a maximum of 25 equivalent feet may be used in the exhaust vent. However, excluding the termination elbow, you can have no more than four elbows in each vent.

VENTING INSTALLATION cont.



FPD VENTING CALCULATIONS

DOWN

INTAKE VENT - MAXIMUM 25 EQUIVALENT FEET
EXHAUST VENT - MAXIMUM 25 EQUIVALENT FEET

- 90° ELBOW = 5 FEET
- 45° ELBOW = 2.5 FEET
- MAXIMUM OF 4 ELBOWS IN EACH VENT.

DO NOT INCLUDE TERMINATION ELBOWS IN CALCULATIONS.

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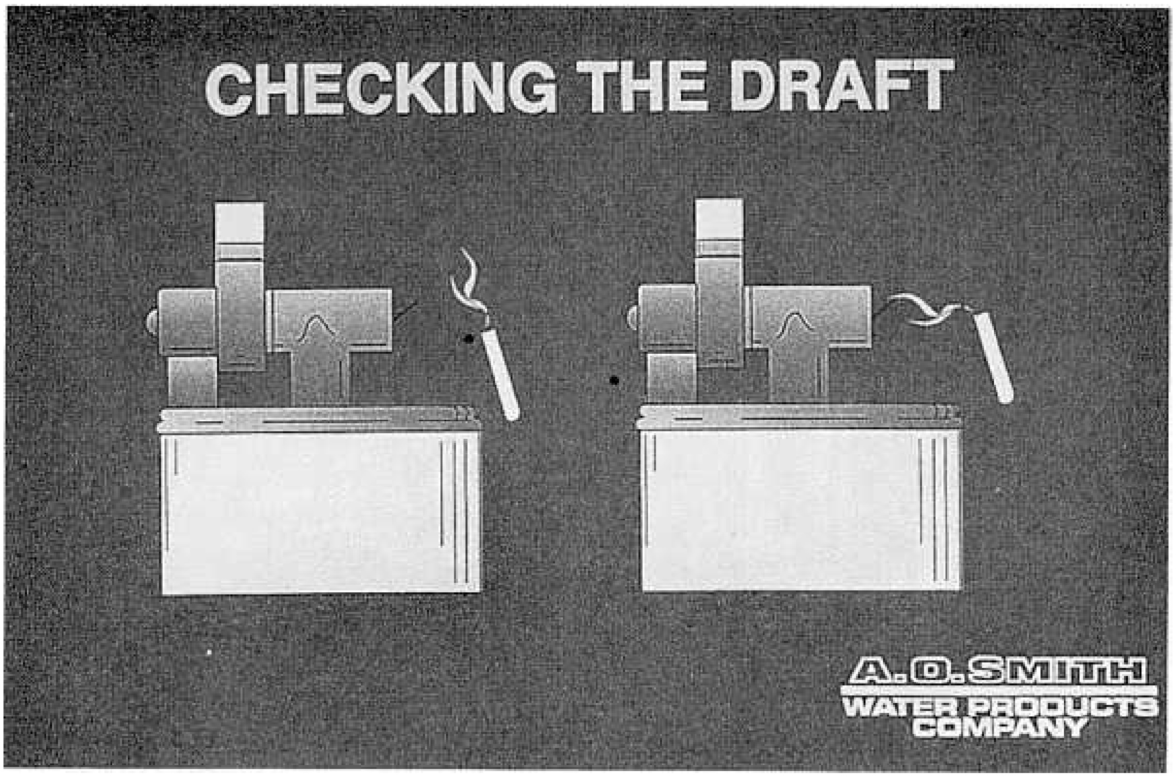
INTAKE VENT

Down Venting Calculations: FPD	Intake and exhaust elbows must be on same surface of the house. Excluding the vent terminations, a maximum of 25 equivalent feet may be used in the intake vent system and a maximum of 25 equivalent feet may be used in the exhaust vent. However, excluding the termination elbow, you can have no more than four elbows in each vent.

AIR FOR COMBUSTION



CHECKING THE DRAFT

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Checking for Draft	On initial start up, check for the correct draft on the Power Shot. To check the draft, place a smoke stick directly in front of the inlet air damper while the heater is firing. A properly operating system will draw the smoke into the inlet air damper as shown in the right illustration. The illustration on the left shows a negative To check for a negative condition close all windows, outside doors, and fireplace dampers. Turn on all exhausting appliances, including kitchen draft hoods, clothes dryers, furnaces, bathroom vents, etc. Open all inner doors between these appliances and the Power Shot. Once all appliances are on and inner doors open, open the inlet air damper on the Power Shot when the heater is not firing. Using your hand, check for air movement. If air is being blown back into the room, a negative pressure condition exists.

AIR FOR COMBUSTION cont.

CONDITION	CAUSE	SOLUTION
Burnt gas odor when heater is operating	Leaking vent joints	Seal vent joints
	Blocked vent	Clear vent blockage

The majority of the complaints associated with the operation of the will likely be a direct result of improper venting. If the customer complains of smelling burnt gas around the water heater, first check for vent gases that may be leaking from the PVC joints or around the area between the blower assembly and water heater. Seal all leaks with the high temperature silicone sealant provided.

Check for restrictions in the venting that may cause some spillage of burnt gas into the room and check your draft, visually inspecting the vent termination for blockage, clearing blockage as necessary.

CONDITION	CAUSE	SOLUTION
Sooting.	Inlet air damper not operational	Correct operation of inlet air damper
Moisture in tube on blower.	Condensation	Install condensate tee
Pilot Outage or pilot gas gas odor on standby.	Insufficient make-up air or back-drafts in vent	Install make-up air ducts

Improper venting is also a major cause of sooting in water heaters. If you experience sooting with the POWER SHOT®, check that the inlet air damper swings freely and opens 1 1/4" when the blower is running.

If water is dripping from the blower, condensate is the culprit. To correct the problem, install a condensate tee, and pipe to drain.

If the customer complains of nuisance pilot outage or pilot gas odor on standby, this may be due to a lack of combustion air, or other appliance (exhaust fans, clothes dryers, etc.) creating a backdraft in the FPS venting. In either case, install additional make-up air ducts.

AIR FOR COMBUSTION cont.

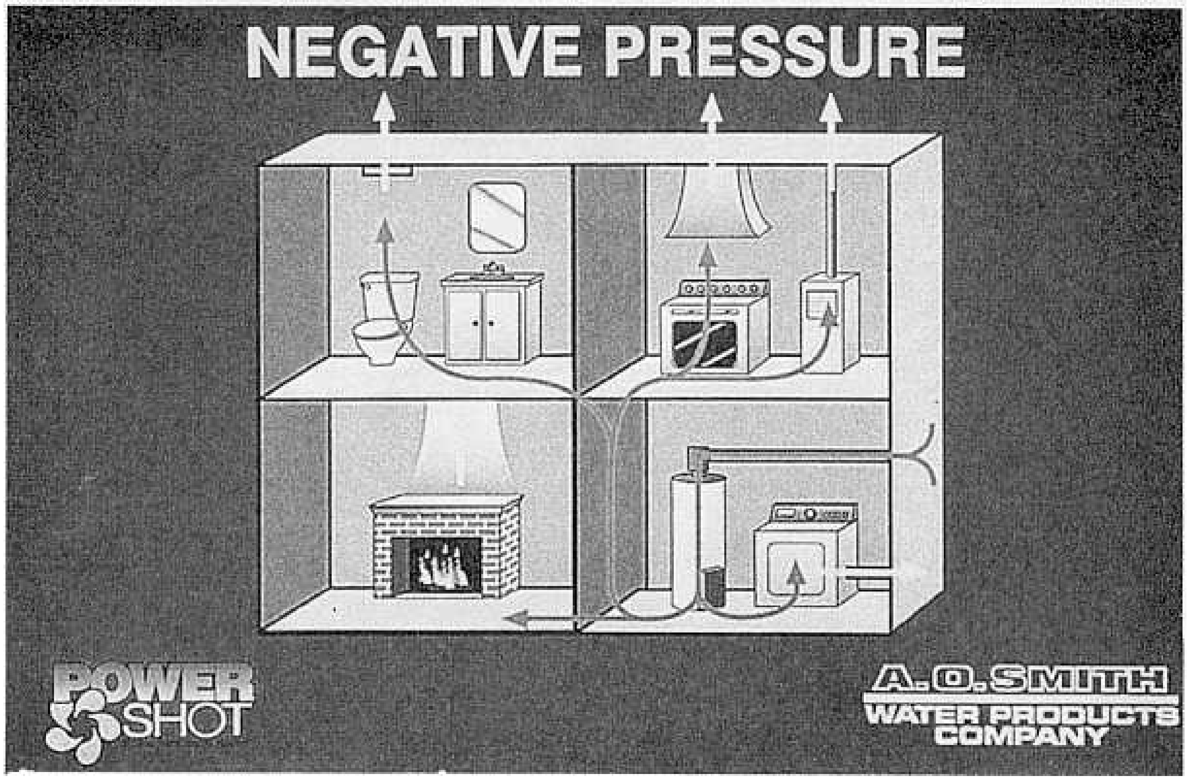
CONDITION	CAUSE	SOLUTION
Excessive heat build-up in PVC venting	Inlet air damper not opening completely	Free air damper
	Blower does not run when main burner fires	Replace entire blower assembly
	Wrong main burner orifice size	Install correct orifice
Intermittent fan cycling without burner operation (Propane Only)	Build up of pressure in the main burner tube between thermostat gas valve and solenoid gas valve	If cycling occurs more than twice per hour, see troubleshooting procedures.

A malfunctioning vent damper may also cause excessive heat buildup in the PVC vent piping If unable to free the damper, replace the entire combustion control tee.

If blower does not run when the main burner fires, replace the control box. Also check burner orifice for correct size.

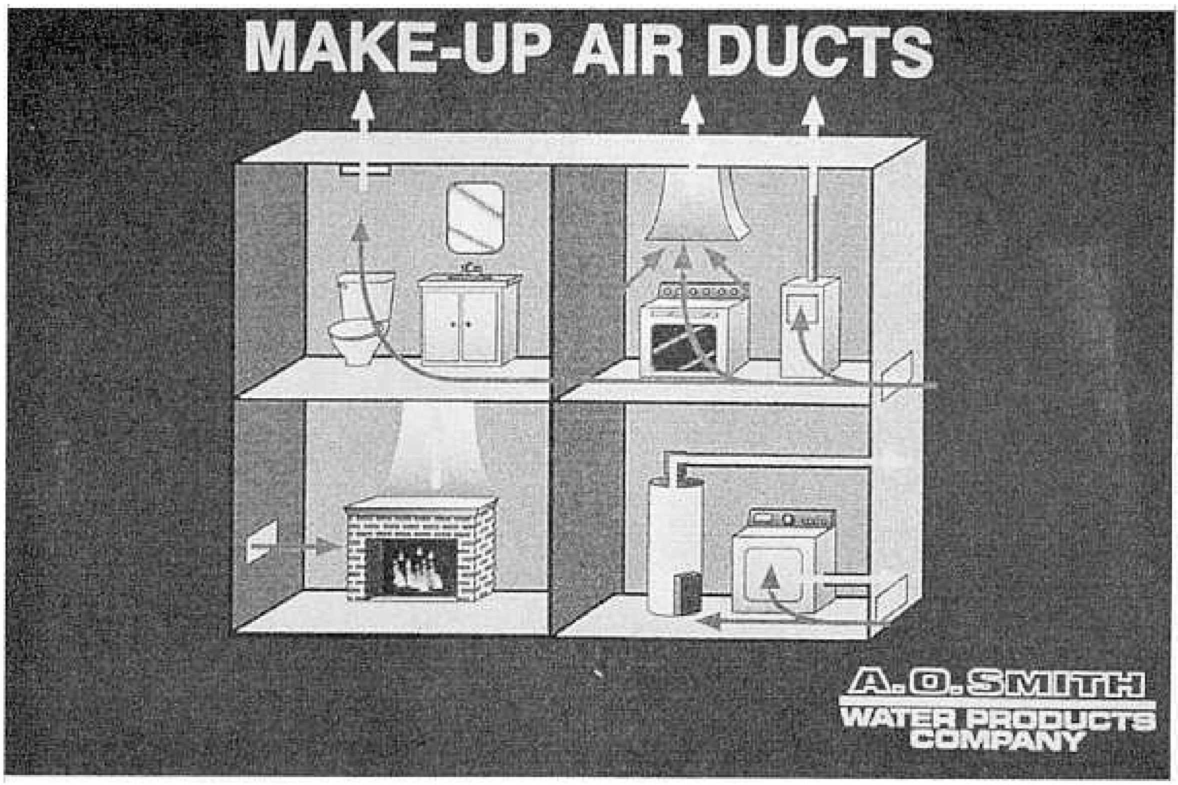
Intermittent cycling of the fan, without main burner operation, indicates a build-up of pressure in the main burner tube between the thermostatic gas valve and solenoid gas valve.

AIR FOR COMBUSTION cont.



Negative Pressure	Diagnosing pilot outage complaints requires an examination of the environment in which the heater is installed. Mechanical vent fans are the chief cause of negative pressure. If the house is too tight, more air will be exhausted from the structure than is being brought in from the outside, resulting in a negative pressure condition. Fireplaces, furnaces, wind, and thermal stacking within the house can also play a role in creating negative pressure conditions. Negative pressure can result from air being backdrafted through the water heater vent down into the combustion chamber, blowing out the pilot. This may happen randomly because it may be a particular combination of appliances which cause the condition.

AIR FOR COMBUSTION cont.


MAKE-UP AIR DUCTS
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Make-up Draft	To alleviate a negative pressure condition, install makeup air ducts (per makeup air specifications listed in the National Fuel Gas Code) of sufficient capacity to allow all appliances requiring makeup air to operate properly.

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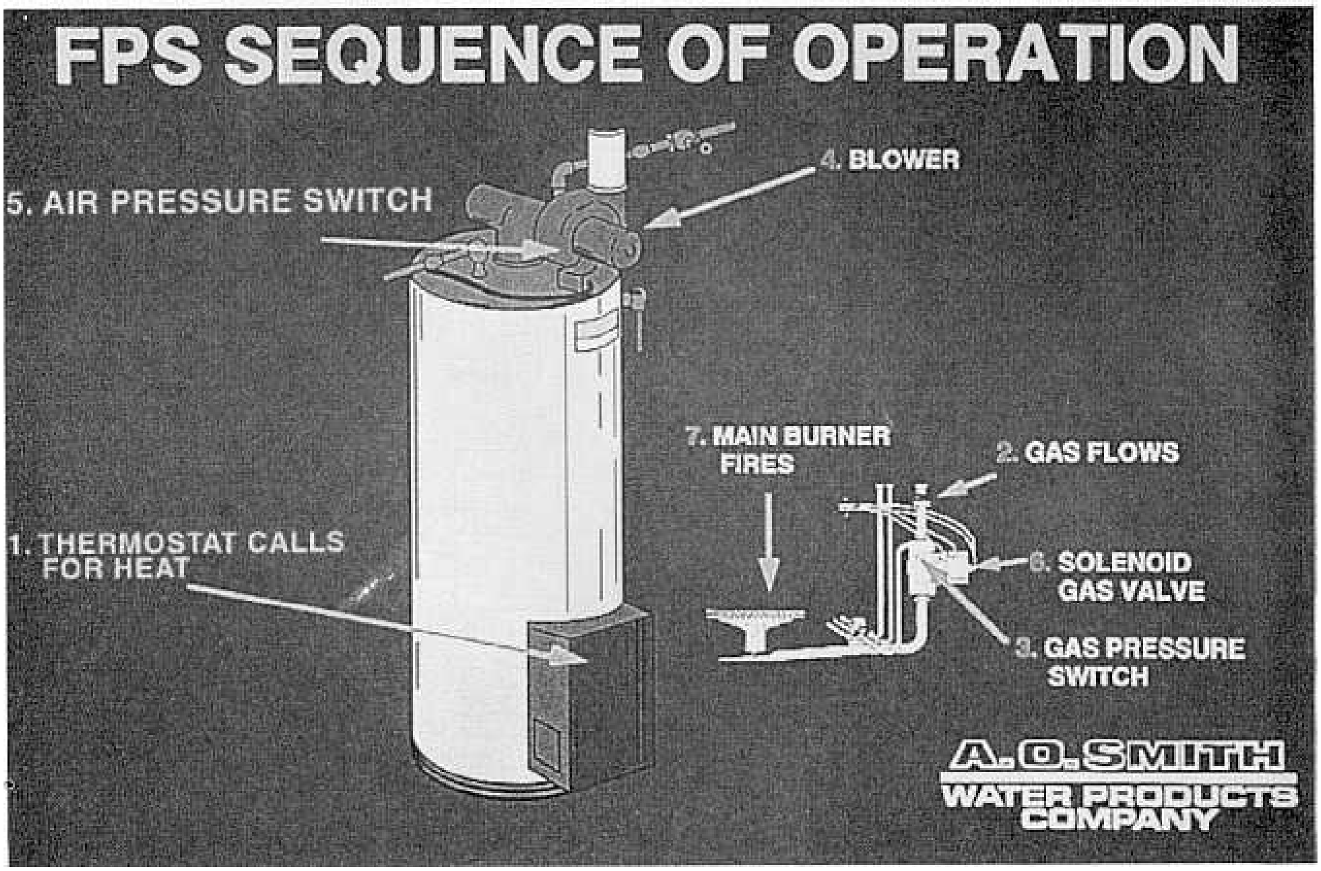
FPS 40 and 50 SERVICE AND OPERATION

Service & Operation Introduction	Most problems will first appear as blower malfunctions; either a blower that does not run or a blower that runs constantly. In these instances, further trouble shooting is required to determine the exact cause. Familiarize yourself with the sequence of operation, study the wiring diagram, and complete the preliminary checks, then if those are OK, go to the section of this workbook that applies to the condition and follow the tests.


FPS SEQUENCE OF OPERATION
4. BLOWER
5. AIR PRESSURE SWITCH
7. MAIN BURNER FIRES
2. GAS FLOWS
1. THERMOSTAT CALLS FOR HEAT
6. SOLENOID GAS VALVE
3. GAS PRESSURE SWITCH
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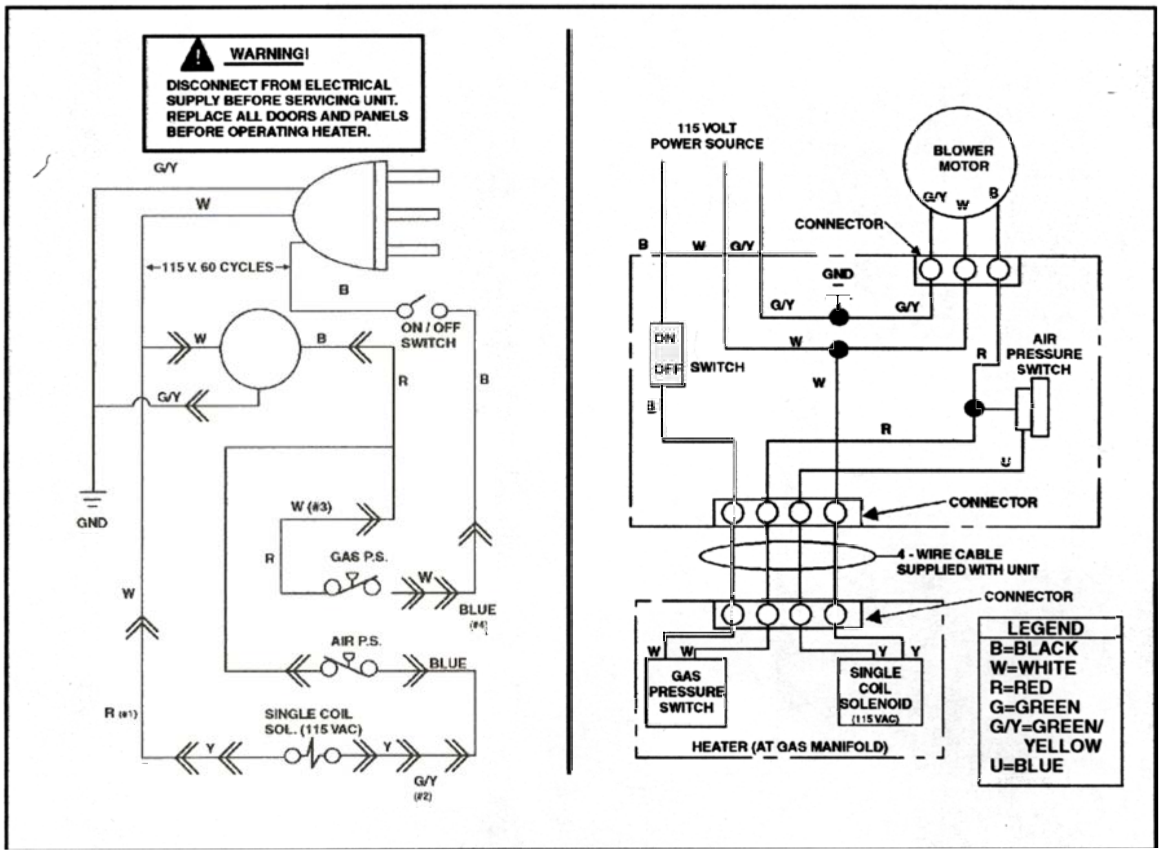
Sequence of Operation	1	Thermostat calls for heat,
	2	Main gas valve opens,
	3	Gas pressure switch closes,
	4	Fan activates,
	5	Air pressure switch closes,
	6	Solenoid opens,
	7	Main burner ignites.

FPS 40 and 50 SERVICE AND OPERATION cont.

Wiring Diagram

The following wiring diagram only applies to model FPS40 -50 series 226 - 227.


WARNING!
DISCONNECT FROM ELECTRICAL SUPPLY BEFORE SERVICING UNIT. REPLACE ALL DOORS AND PANELS BEFORE OPERATING HEATER.
G/Y
W
115 V. 60 CYCLES
B
ON / OFF SWITCH
W
B
R
B
G/Y
GND
W (#3)
R
GAS P.S.
W
BLUE (#4)
W
AIR P.S.
BLUE
R (#1)
SINGLE COIL SOL. (115 VAC)
Y
Y
G/Y (#2)
115 VOLT POWER SOURCE
BLOWER MOTOR
G/Y
W
B
CONNECTOR
B
W
G/Y
GND
G/Y
G/Y
ON
OFF
SWITCH
B
W
R
AIR PRESSURE SWITCH
W
R
U
CONNECTOR
4 - WIRE CABLE SUPPLIED WITH UNIT
CONNECTOR
W
W
Y
Y
GAS PRESSURE SWITCH
SINGLE COIL SOLENOID (115 VAC)
HEATER (AT GAS MANIFOLD)
LEGEND
B=BLACK
W=WHITE
R=RED
G=GREEN
G/Y=GREEN/ YELLOW
U=BLUE

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FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting	To troubleshoot the FPS you must understand its sequence of operation. Review that section if necessary. In addition, installation problems can cause the heater to malfunction. Review sections on venting and checking draft. Most problems with the heater will first appear as blower malfunctions.

Subject	**Page**
Preliminary Checks	Pages 24 and 25
Blower does not run	Page 26
Blower runs constantly (No call for heat)	Page 30
Blower runs constantly (No main burner)	Page 34
Pilot Problems	Page 38
Main Burner Problems	Page 39

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FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

PRELIMINARY CHECKS
1. Gas valve knob is in ON position.
2. Pilot is burning.
3. 120 VAC is supplied to heater.
4. Thermostat is calling for heat (See page 25)
5. Blower ON/OFF switch is in the ON position.
6. Connection between blower motor and blower control box is secure.
7. Heater is installed per manual.

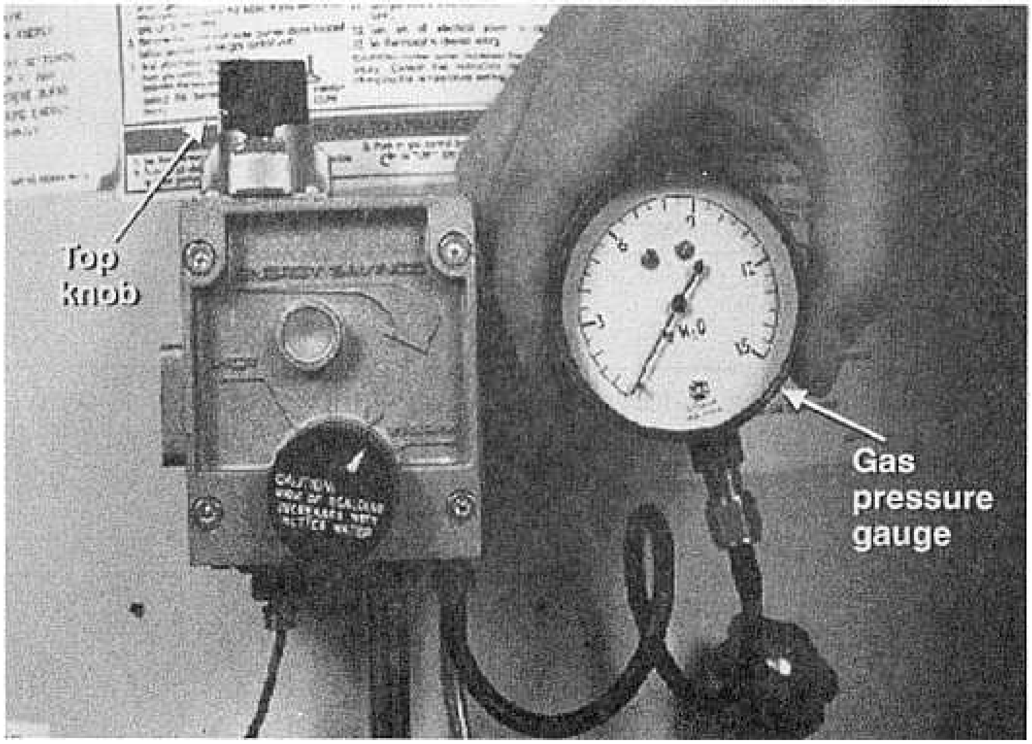
RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items as you would on any standard residential gas water heater.

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.



PRELIMINARY THERMOSTAT TEST

SET UP THE TEST

- Place top knob on gas valve to "OFF" position,
- remove pressure tap set screw from bottom of gas valve,
- connect gas pressure gauge to gas pressure tap, relight pilot,
- rotate thermostat dial to call for heat, then
- place top knob on gas valve to "ON" position. (Caution: check for gas leaks)

RESULTS

If the gas pressure gauge:	then:
does not pressurize to read (4.0 " w.c. natural gas or 10 " w. c. propane gas),	replace the valve.
does pressurize to read (4.0 " w.c. natural gas, 10 " w c. propane gas)	the gas valve is OK. Continue to Step 1 of the troubleshooting procedures.

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FPS 40 and 50 SERVICE AND OPERATION cont.

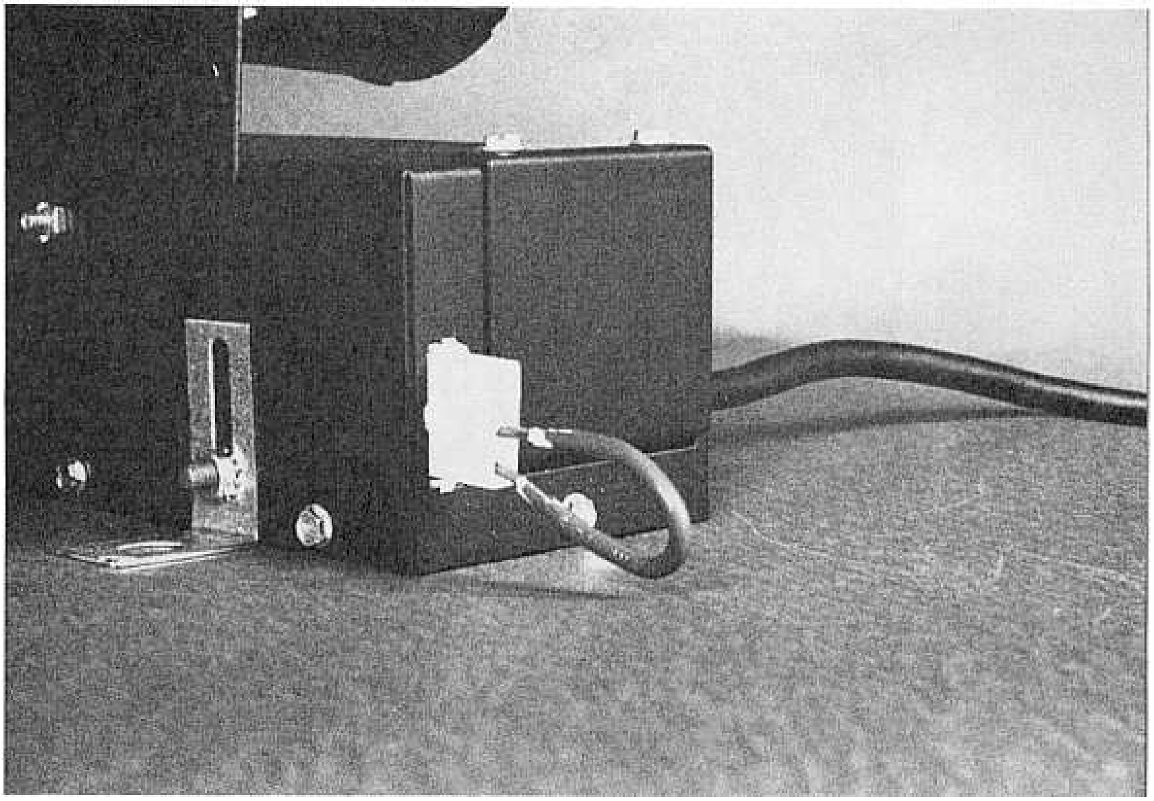
Trouble-shooting cont.	**BLOWER DOES NOT RUN** First make the **Preliminary Checks (see page 24)**, then perform each of the following tests until cause of the failure is determined: **1. Blower Test** **2. Cable Test** **3. Harness**

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 1	BLOWER TEST
	SET UP THE TEST - Disconnect the 4 wire cable from the fan control box, then - using an insulated jumper wire (caution 120 VAC), jump between pins 3 and 4 on receptacle as shown.

RESULTS

If:	then:
the fan does not run,	replace the fan assembly.
the fan does run,	go to Step 2.

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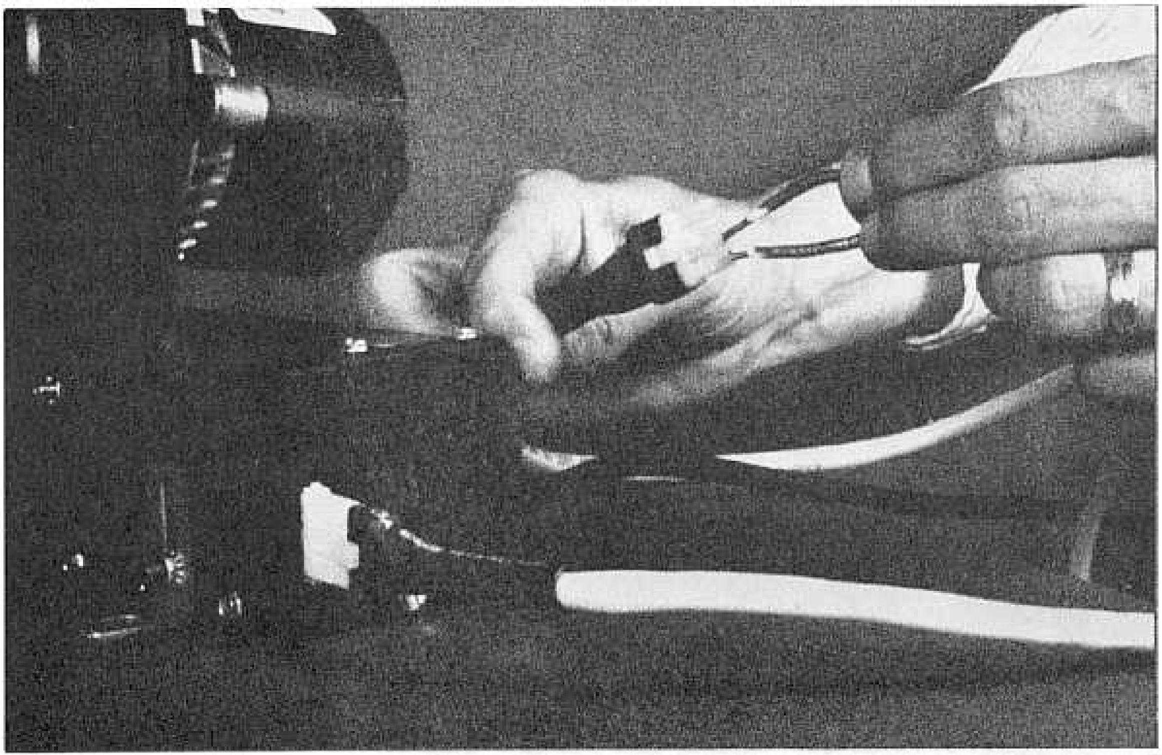
FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 2

CABLE TEST

SET TEST UP

- Reconnect the 4 wire cable onto the fan control box,
- disconnect the cable from the control cover below, then
- using an insulated jumper wire, jump between pins 3 and 4 on plug as shown.

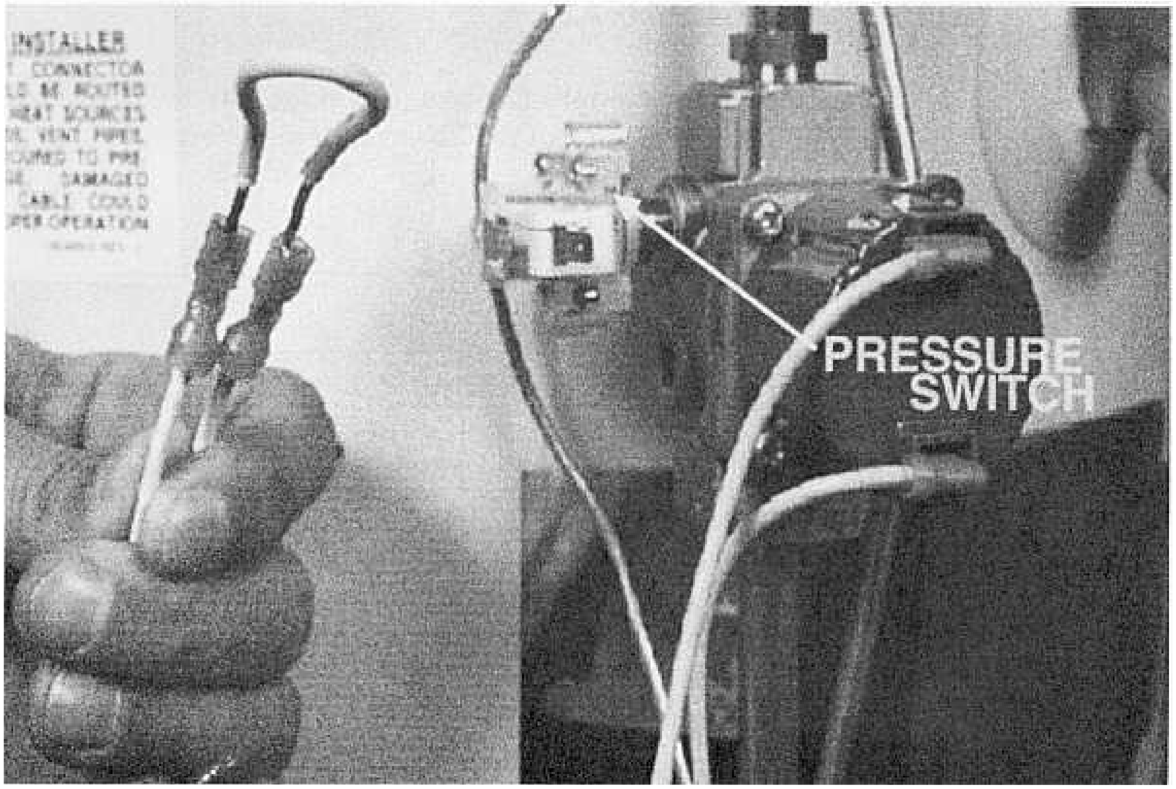
RESULTS

If:	then:
the fan does not run,	replace the cable.
the fan does run,	go to Step 3.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 3

HARNESS TEST

SET UP THE TEST

- Reconnect the 4 wire cable onto control box cover,
- disconnect the 2 wires from the gas pressure switch, then
- using an insulated jumper wire, jump between the 2 wires as shown.

RESULTS

If:	then:
the fan does not run,	replace the harness.
the fan does run,	replace the gas pressure switch.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.	**BLOWER RUNS CONSTANTLY** (NO CALL FOR HEAT) First make the **Preliminary Checks (see page 24)**, then perform each of the following tests until cause of the failure is determined: **1. Blower Test** **2. Cable Test** **3. Harness Test**

PRELIMINARY CHECKS EXCEPTIONS

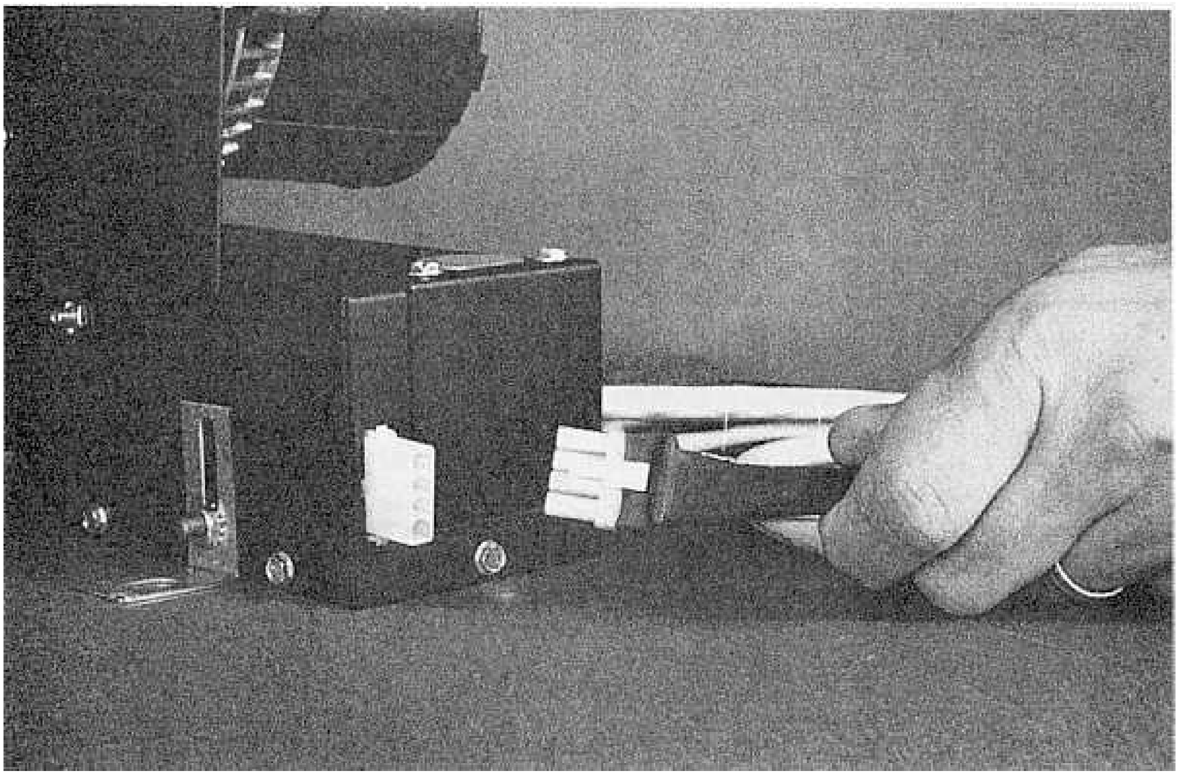
4. Thermostat should not be calling heat. (See page 25)

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



STEP 1	**BLOWER TEST**
	SET UP THE TEST - Disconnect the 4 wire cable from the fan control box as shown.

RESULTS

If:	then:
the fan continues to run,	replace the fan assembly.
the fan stops,	go to Step 2.

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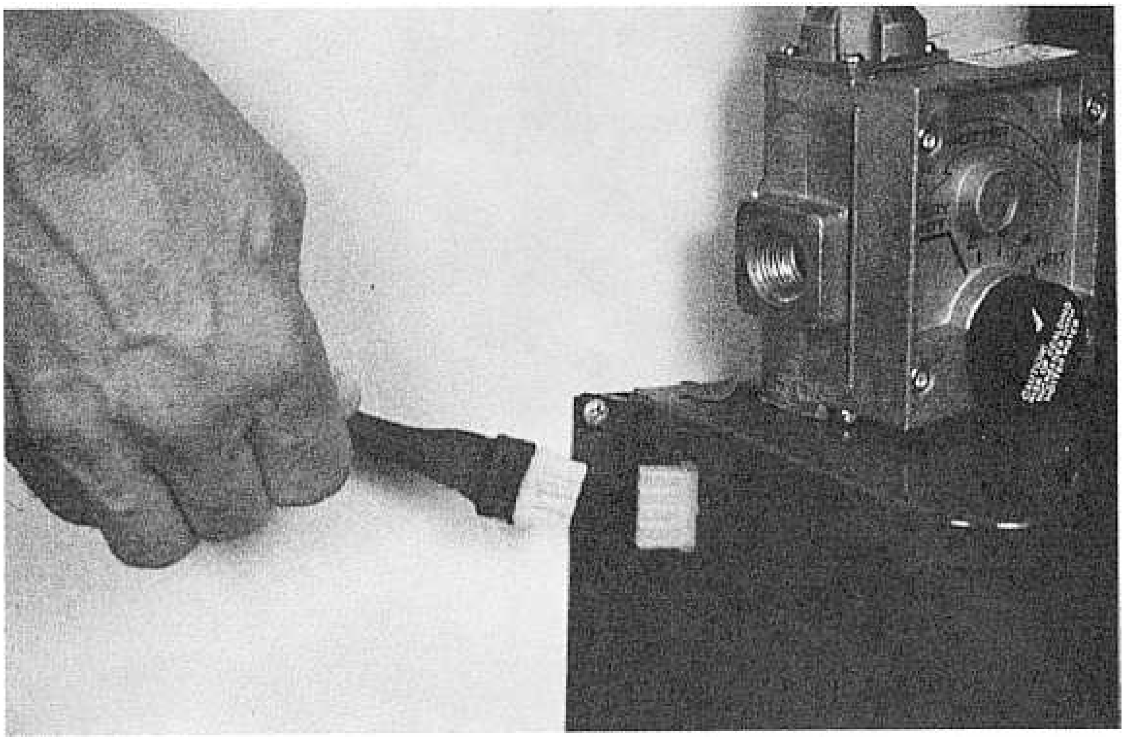
FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



STEP 2	CABLE TEST
	SET UP THE TEST - Reconnect the 4 wire cable onto the fan control box, then - disconnect the cable from the control box cover below as shown.

RESULTS

If:	then:
the fan continues to run,	replace the cable.
the fan stops,	go to Step 3.

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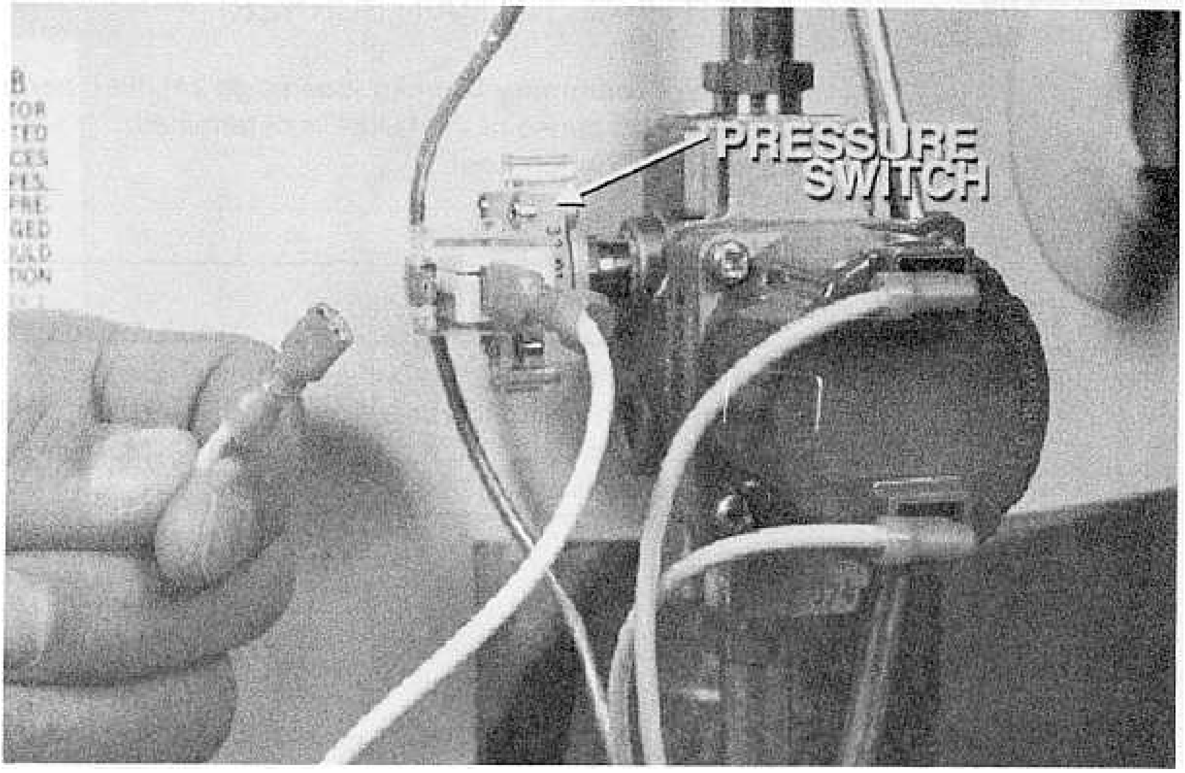
FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



STEP 3

HARNESS TEST

SET UP THE TEST

- Reconnect the 4 wire cable onto the control box cover, then
- disconnect one of the wires from the gas pressure switch as shown.

RESULTS

If:	then:
the fan continues to run,	replace the harness.
the fan stops,	replace the gas pressure switch.

FPS 40 and 50 SERVICE AND OPERATION cont.

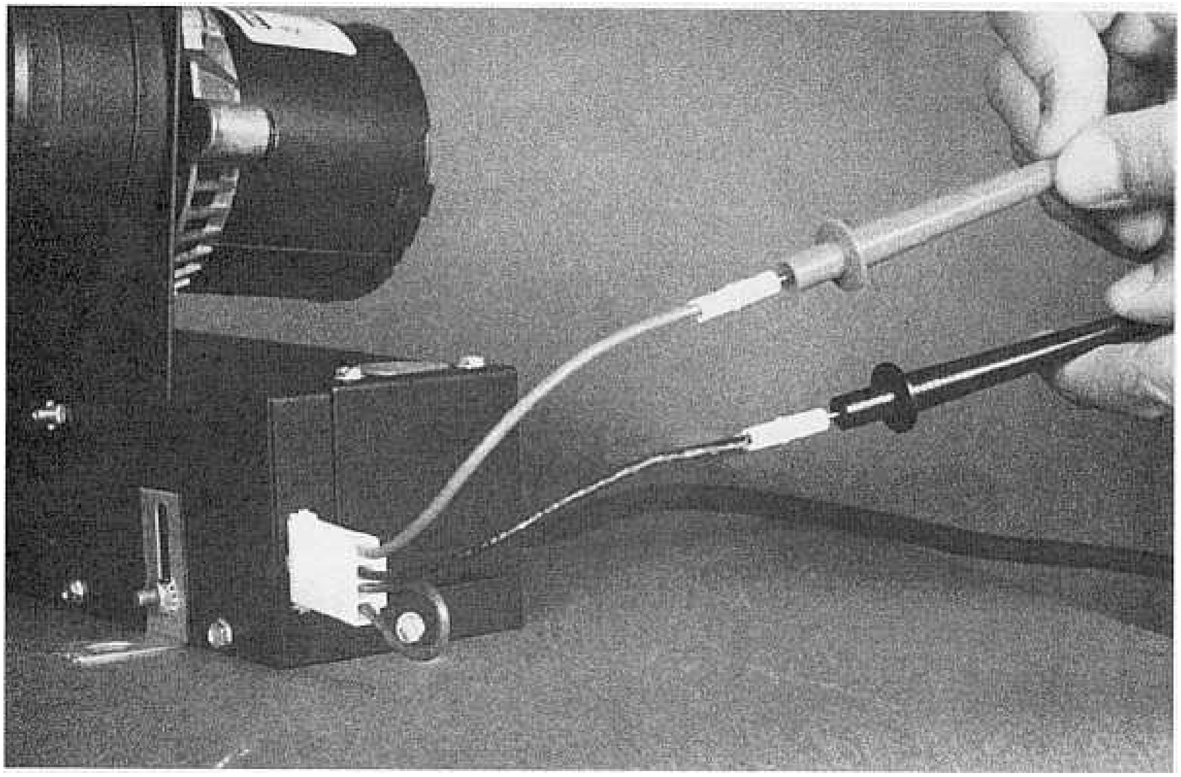
Trouble-shooting cont.	**BLOWER RUNS CONSTANTLY** (CALL FOR HEAT, NO MAIN BURNER) First make the **Preliminary Checks (see page 24)**, then perform each of the following tests until cause of the failure is determined: **1. Air Pressure Switch Test** **2. Cable Test** **3. Harness Test**

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No main burner) cont.



STEP 1	AIR PRESSURE SWITCH TEST
	SET UP THE TEST - Disconnect the 4 wire cable from the fan control box, - using an insulated jumper wire, jump between pins 3 and 4 on the receptacle , then - using a multimeter, test for 120 VAC between pins 1 and 2 as shown.

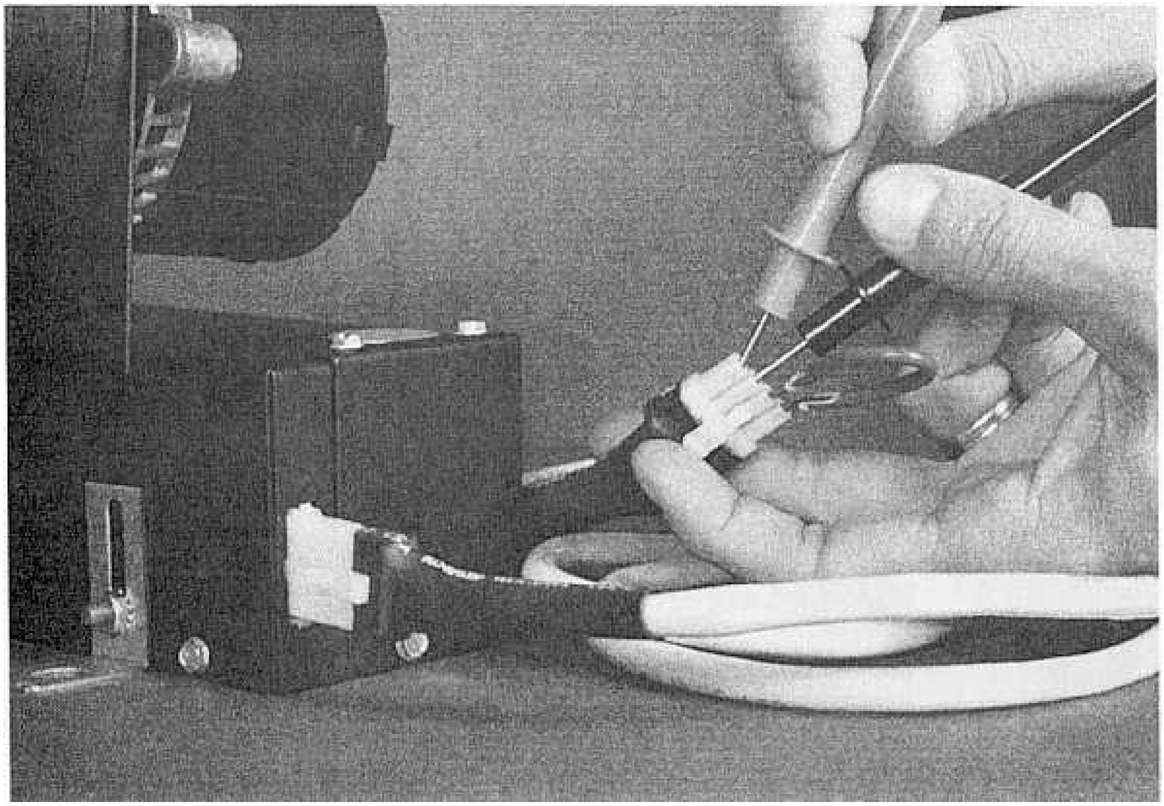
RESULTS

If:	then:
the meter does not read 120 VAC,	replace the air switch.
the meter does read 120 VAC,	go to Step 2.

FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No main burner) cont.



STEP 2	CABLE TEST
	SET UP THE TEST - Reconnect the 4 wire cable to the fan control box, - disconnect the 4 wire cable from the control box cover below, - using an insulated jumper wire, jump between pins 3 and 4 on the plug, then - using a multimeter, test for 120 VAC between pins 1 and 2 as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace the cable.
the meter does read 120 VAC,	go to Step 3.

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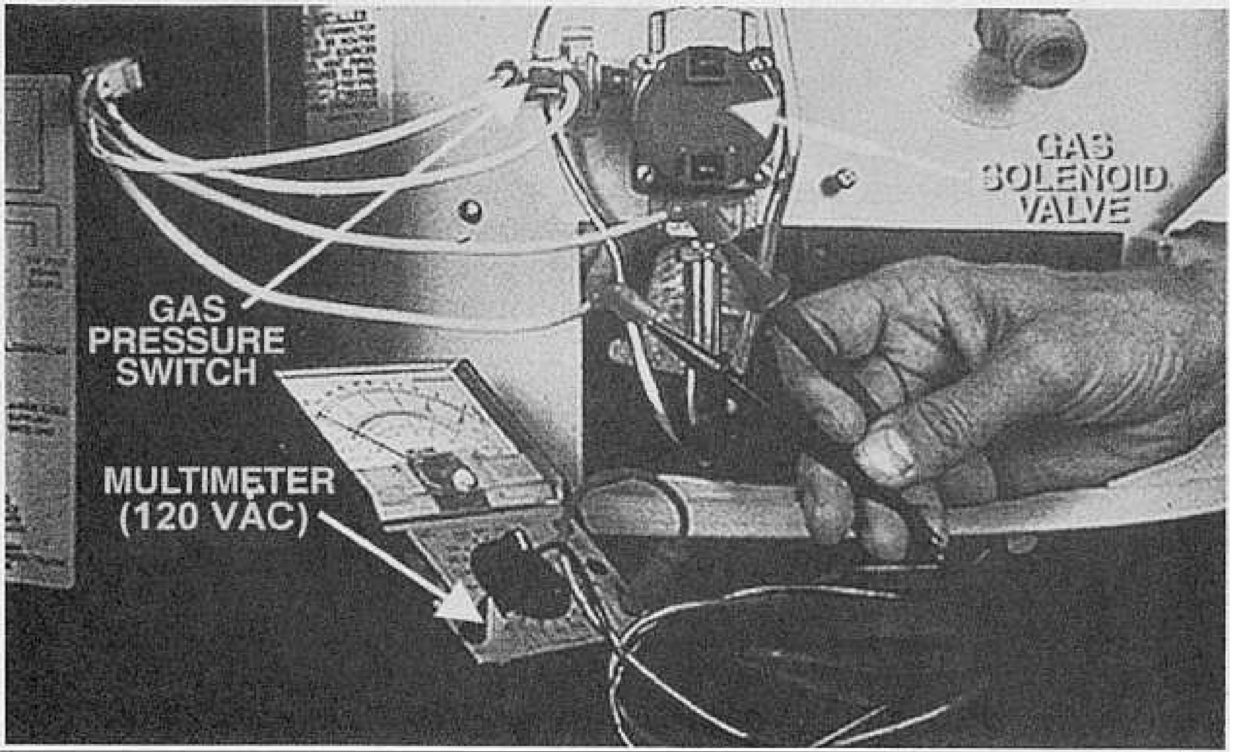
FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont. BLOWER RUNS CONSTANTLY (No main burner) cont.



STEP 3	**HARNESS TEST**
	SET UP THE TEST - Reconnect the 4 wire cable to the control box cover, - disconnect the 2 wires from the solenoid, then - using a multimeter, test for 120 VAC between wires as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace the harness.
the meter does read 120 VAC,	replace the solenoid.

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FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

PILOT PROBLEMS

The following are possible causes of pilot problems:

1. Incorrect pilot position; the pilot should engulf the tip of the thermocouple 3\8" to 1\2".
2. Incorrect thermocouple output; it should generate 7 or more millivolts when pilot is burning.
3. Incorrect pilot gas pressure; it should be 3.5" for natural gas and 10" for propane.
4. Excessive equivalent foot length on vents can cause pilot outages.
5. Backdraft can cause pilot outages. (See page 16).
6. An open E.C.O. will not allow the heater to be relit.
7. A leak in the pilot tube will cause candling.

RESULTS

If:	then:
Any of these seem to be the problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

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FPS 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

MAIN BURNER PROBLEMS

The following are possible causes of main burner problems:

1. Unlevel burner will cause yellow flames.
2. Burning and the orifice indicates main gas valve may not be fully closing.
3. Incorrect manifold gas pressure; it should be 3.5" for natural gas and 10" for propane.
4. Soot build-up. Check gas pressure and air flow through heater and venting.

RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

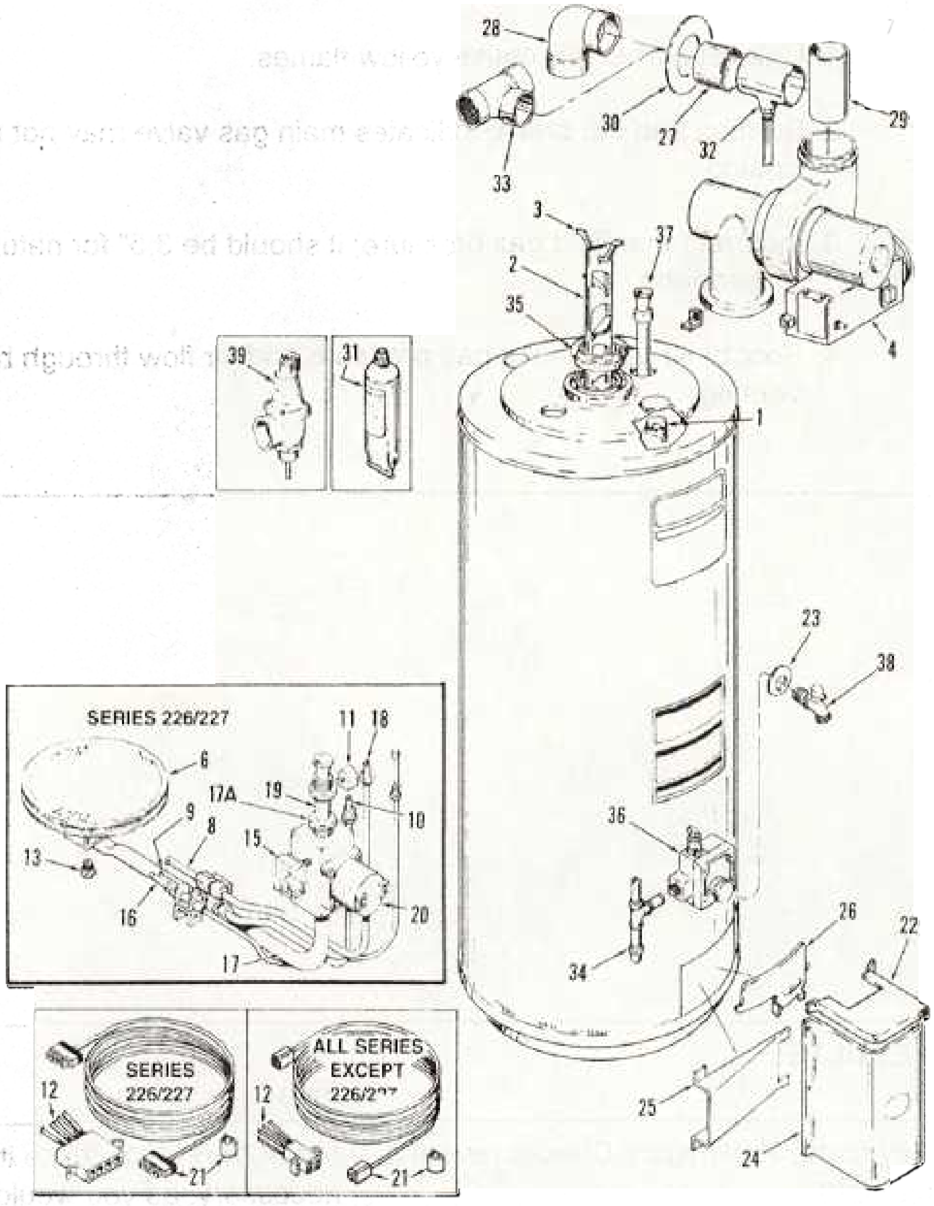
FPS 40 and 50 PARTS LIST

PSD-1-263/b

GAS

RESIDENTIAL WATER HEATER PARTS LIST

MODELS FPS-40 AND 50
SERIES 226/227


28
30
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4
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23
38
SERIES 226/227
11
18
6
17A
19
9
8
10
15
13
16
20
17
36
34
26
22
25
24
12
SERIES 226/227
21
12
ALL SERIES EXCEPT 226/227
21

A. O. SMITH
WATER PRODUCTS COMPANY
5621 W. 115TH STREET, ALSIP, ILLINOIS 60482/1-800-433-2545

PRINTED IN U.S.A.

April 1994

Item	Description	Series 226/227	
		FPS-40	FPS-50
1	Anode	43817-25	43817-38
2	Baffle, Flue	181382	181382
3	Baffle, Hanger	181360	181360
4	Blower, Assembly	181920	181920
5	Burner Assembly Natural	181936	181936 2
	Burner Assembly Propane	181936-1	181936-3
6	Burner Head	181806	181806
7	Burner with Pilot (Including Item 14)		
	Natural Gas		- - - -
	Propane Gas	- - - -	- - - -
8	Burner Pilot, Natural	181805-3	181805-3
	Burner Pilot, Propane	181805-2	181805-2
9	Bleed Pilot, Natural Only	181804-2	181804-2
10	Bleed Tube, Natural Only	23330	23330
11	Bleed Elbow, Natural Only	181825	181825
12	Harness, Wiring	181890	181890
13	Orifice, Main Burner, Natural	181508-31	181508-31
	Orifice, Main Burner, Propane	181791-50	181791-50
14	Orifice, Pilot, Natural	- - - -	- - - -
	Orifice, Pilot, Propane	- - - -	- - - -
15	Switch, Pressure, Natural	180997-1	180997-1
	Switch, Pressure, Propane	181044-1	181044-1
16	Thermocouple	23675	23675
17	Tube, Lower Burner, Natural	181887	181887-1
	Tube, Lower Burner, Propane	181914	181914-1
17A	Nut-Optic (Use with Item 17 & 19)		
18	Tube, Pilot	23330	23330
19	Tube, Upper Burner	181192	181192
20	Valve, Solenoid Natural	181916	181916
	Valve, Solenoid Propane	181917	181917
21	Cable, Control w/Clips	181728-1	181728-1
22	Cap, Power Vent Door	181286	181286
23	Collar, Pipe	20172-14	20172-14
24	Cover, Gas Control String	180540-1	180540-1
25	Door, Burner Compartment	181255-700	181255-700
26	Door, Inner	180596	180596
	Kit, Vent Pipe		
27	Coupling	- - -	
28	Elbow, Discharge with Screen	- - - -	- - - -
29	Pipe, P.V.C. 3" x 12"	181531	181531
30	Plate, Outer/Inner Wall	181557	181557
*31	Sealer, Tube High Temp. Silicone Sealant	181564	181564
32	Tee, Condensate Assembly	181861	181861
33	Tee, Discharge with Screen	181617	181617
34	Leg, Dirt Assembly (Propane Only)	181206	181206
35	Restrictor, Flue	34894	34894
36	Thermostat, Natural	180193-5	180193-5
	Thermostat, Propane	181775-2	181775-2
37	Tube, Inlet	21062-26	21062-31
38	Valve, Drain	42037	42037-1
39	Valve, T & P	43151-2	43151-2

* Sealant must conform to MIL-A-46106A, type 1/FDA21 CFR 175.300. Must be able to withstand constant high temperature of 450°F and a low of -75°F Equal to National Polymer Products, Sealcon II.

Part numbers underlined are recommended stock items for emergency replacement. (Consider gas used in your area only).

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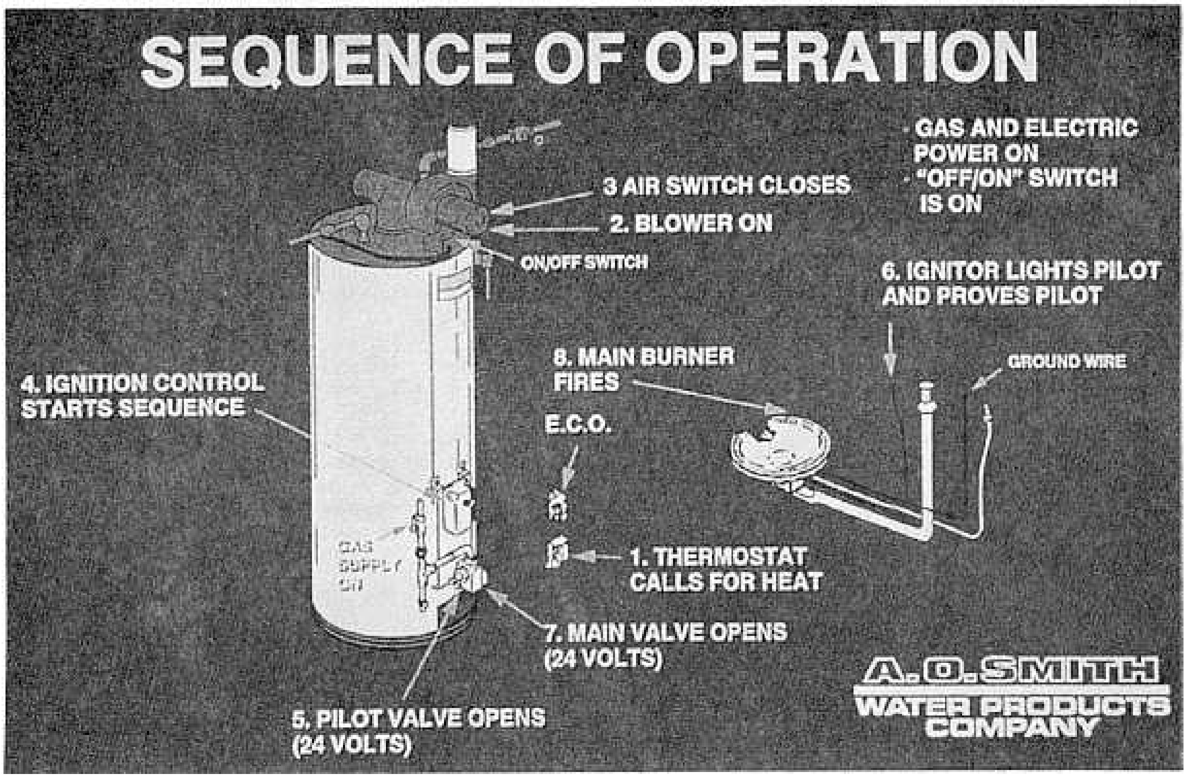
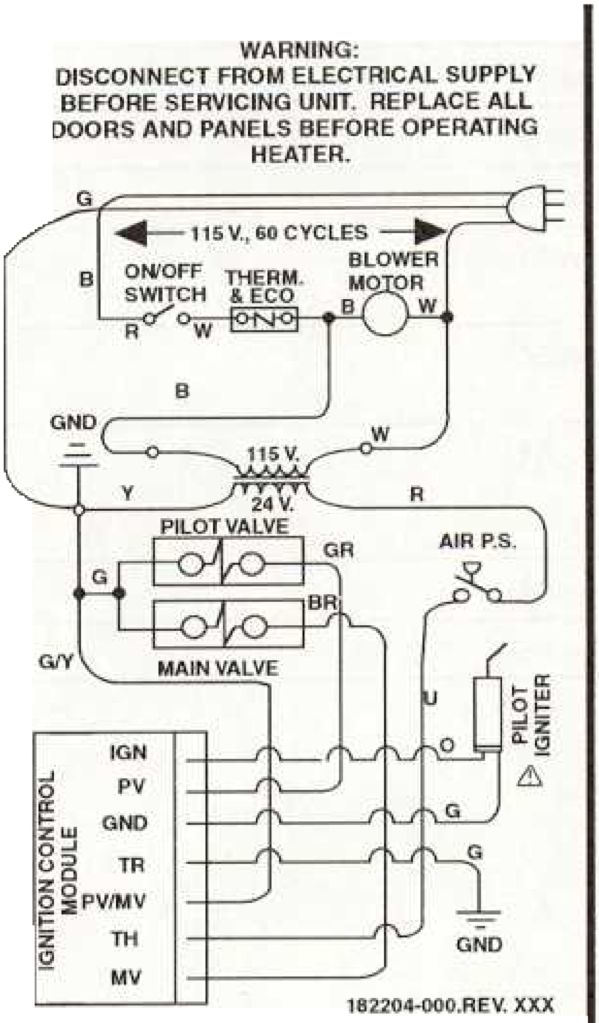
FPSE 40 and 50 SERVICE AND OPERATION
FPD 40 and 50 SERVICE AND OPERATION

Service & Operation Introduction	Most problems will first appear as blower malfunctions; either a blower that does not run or a blower that runs constantly. In these instances, further trouble shooting is required to determine the exact cause. Familiarize yourself with the sequence of operation, study the wiring diagram, and complete the preliminary checks, then if those are OK, go to the section of this workbook that applies to the condition and follow the tests.

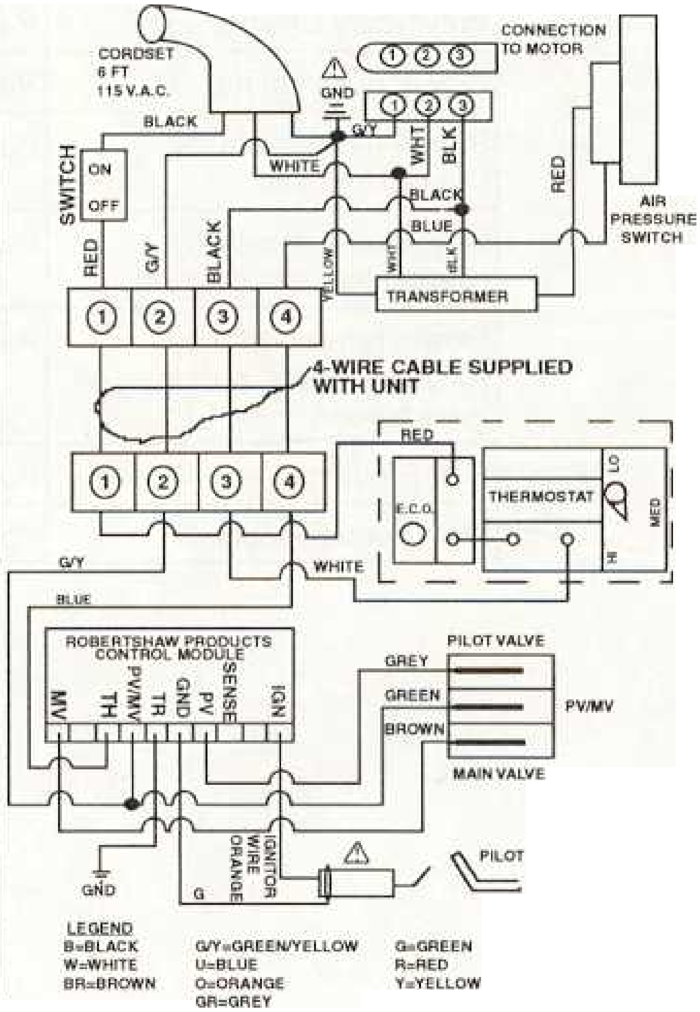

SEQUENCE OF OPERATION
· GAS AND ELECTRIC POWER ON
· "OFF/ON" SWITCH IS ON
3 AIR SWITCH CLOSES
2. BLOWER ON
ON/OFF SWITCH
6. IGNITOR LIGHTS PILOT AND PROVES PILOT
GROUND WIRE
8. MAIN BURNER FIRES
4. IGNITION CONTROL STARTS SEQUENCE
E.C.O.
GAS SUPPLY ON
1. THERMOSTAT CALLS FOR HEAT
7. MAIN VALVE OPENS (24 VOLTS)
5. PILOT VALVE OPENS (24 VOLTS)
A.O. SMITH
WATER PRODUCTS COMPANY

Sequence of Operation	1 Thermostat calls for heat, 2 Blower activates, 3 Air pressure switch closes, 4 Ignition starts, 5 Pilot valve opens, 6 Ignitor lights pilot and proves pilot, 7 Main valve opens, 8 Main burner ignites.

Wiring Diagram	This wiring diagram only applies to models FPSE 40 & 50 series 226E and models FPD 40 & 50 series 226 - 227.


WARNING:
DISCONNECT FROM ELECTRICAL SUPPLY BEFORE SERVICING UNIT. REPLACE ALL DOORS AND PANELS BEFORE OPERATING HEATER.

G
115 V., 60 CYCLES
B
ON/OFF SWITCH
THERM. & ECO
BLOWER MOTOR
R
W
B
W
B
GND
W
115 V.
24 V.
Y
R
PILOT VALVE
GR
AIR P.S.
G
BR
G/Y
MAIN VALVE
U
PILOT IGNITER
O
IGNITION CONTROL MODULE
IGN
PV
GND
TR
PV/MV
TH
MV
G
G
GND
182204-000,REV. XXX


CORDSET
6 FT
115 V.A.C.
GND
CONNECTION TO MOTOR
① ② ③
① ② ③
BLACK
G/Y
WHITE
WHT
BLK
SWITCH
ON
OFF
RED
BLACK
BLUE
AIR PRESSURE SWITCH
RED
G/Y
BLACK
YELLOW
WHT
BLK
TRANSFORMER
① ② ③ ④
4-WIRE CABLE SUPPLIED WITH UNIT
① ② ③ ④
RED
E.C.O.
THERMOSTAT
LO
MED
HI
G/Y
WHITE
BLUE
ROBERTSHAW PRODUCTS CONTROL MODULE
MV
TH
PV/MV
TR
GND
PV
SENSE
IGN
PILOT VALVE
GREY
GREEN
BROWN
PV/MV
MAIN VALVE
GND
G
IGNITOR WIRE ORANGE
PILOT
LEGEND
B=BLACK
W=WHITE
BR=BROWN
G/Y=GREEN/YELLOW
U=BLUE
O=ORANGE
GR=GREY
G=GREEN
R=RED
Y=YELLOW

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting	To troubleshoot the FPSE and FPD you must understand its sequence of operation. Review that section if necessary. In addition, installation problems can cause the heater to malfunction. Review sections on venting and checking draft. Most problems with the heater will first appear as blower malfunctions.

Subject	**Page**
Preliminary Checks	Page 45
Blower does not run	Page 46
Blower runs constantly (No call for heat)	Page 51
Blower runs constantly (Calling for heat, no pilot)	Page 54
Blower runs constantly (Calling for heat, pilot is lit, no main burner)	Page 61
Pilot Problems	Page 64
Main Burner Problems	Page 65

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FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

PRELIMINARY CHECKS

1. Gas valve knob is in ON position.
2. 120 VAC is supplied to heater.
3. *Thermostat is calling for heat. (See page 50)*
4. Blower ON/OFF switch is in the ON position.
5. Connection between blower motor and blower control box is secure.
6. High limit is closed. (See page 49)
7. Heater is installed per manual.

RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

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FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

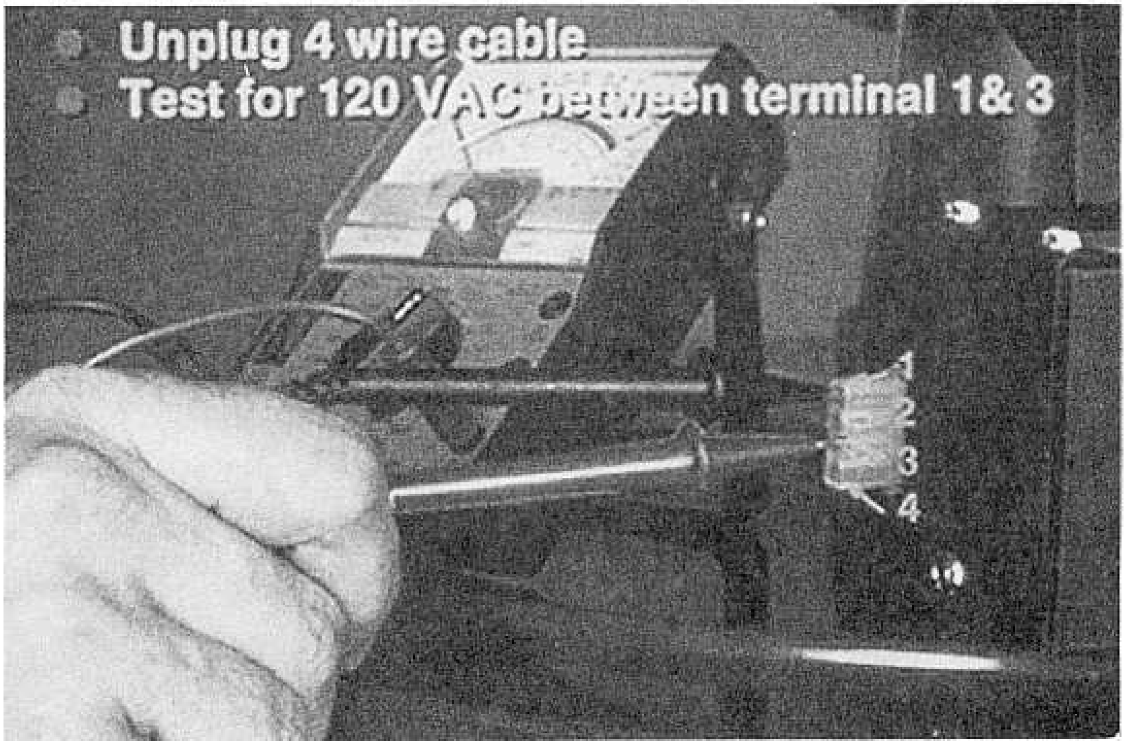
Trouble-shooting cont.	**BLOWER DOES NOT RUN** First make the **Preliminary Checks (see page 45)**, then perform each of the following tests until cause of the failure is determined: **1. Blower Test** **2. Cable Test** **3. High Limit Test** **4. Thermostat Test**

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 1

BLOWER TEST

SET UP THE TEST

- Disconnect the 4 wire cable from the blower control box, then
- using a multimeter, test for 120 VAC between pins 1 and 3 on the control box receptacle as shown.

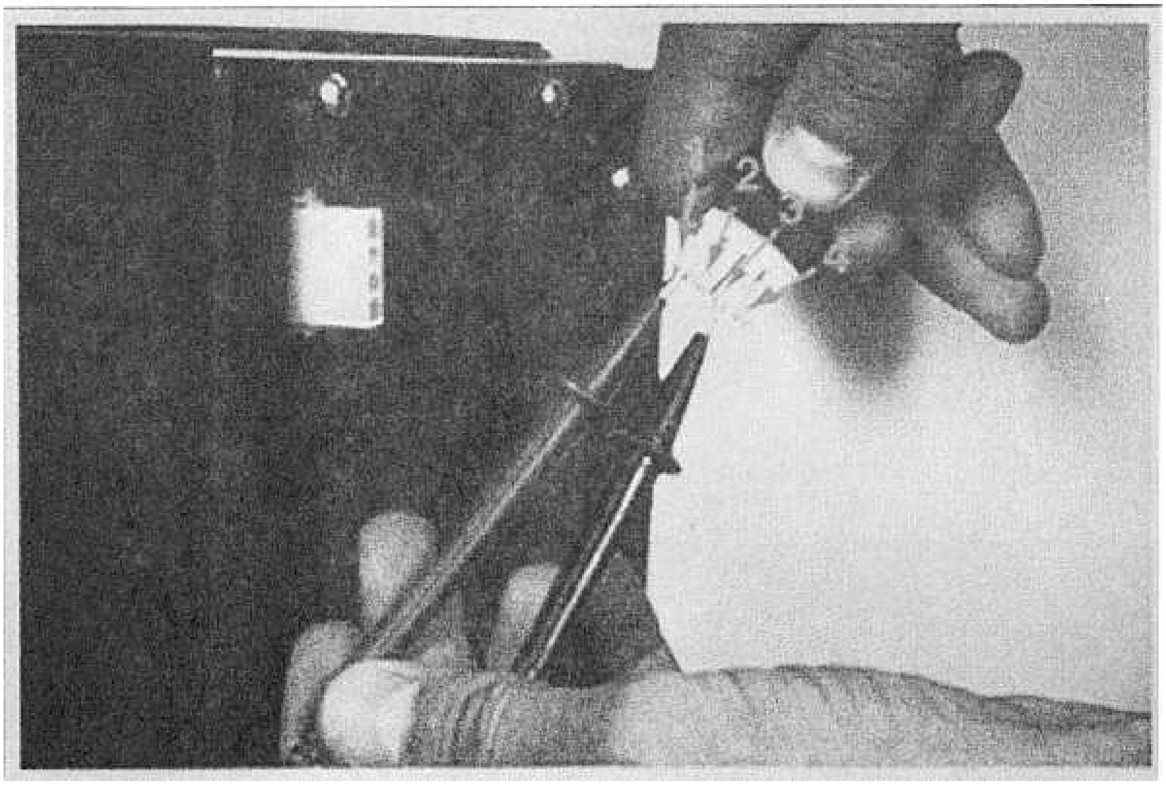
RESULTS

If:	then:
the meter does not read 120 VAC,	replace the blower assembly.
the meter does read 120 VAC,	go to Step 2.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 2

CABLE TEST

SET TEST UP

- Reconnect cable to blower control box,
- disconnect cable from receptacle on door below, then
- using a multimeter, test for 120 VAC between pins 1 and 3 on the cable plug as shown.

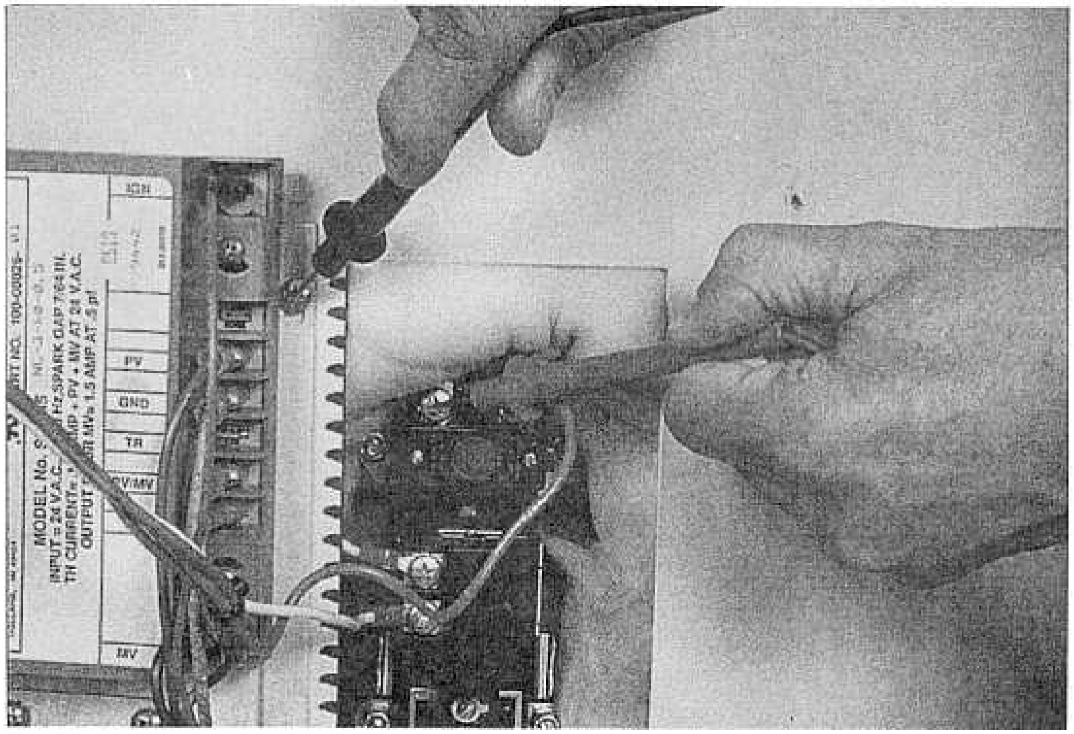
RESULTS

If:	then:
the meter does not read 120 VAC,	replace the cable.
the meter does read 120 VAC,	go to step 3.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 3

HIGH LIMIT TEST

SET UP THE TEST

- Reconnect cable to the receptacle on the door,
- remove front cover from the door,
- inspect the wire from connector to the high limit for lack of continuity or loose connections, correct either of these conditions if necessary,
- make sure the red button on the high limit is depressed,
- using a multimeter, test for 120 VAC at screw on high limit and ground as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace high limit.
the meter does read 120 VAC,	go to Step 4.

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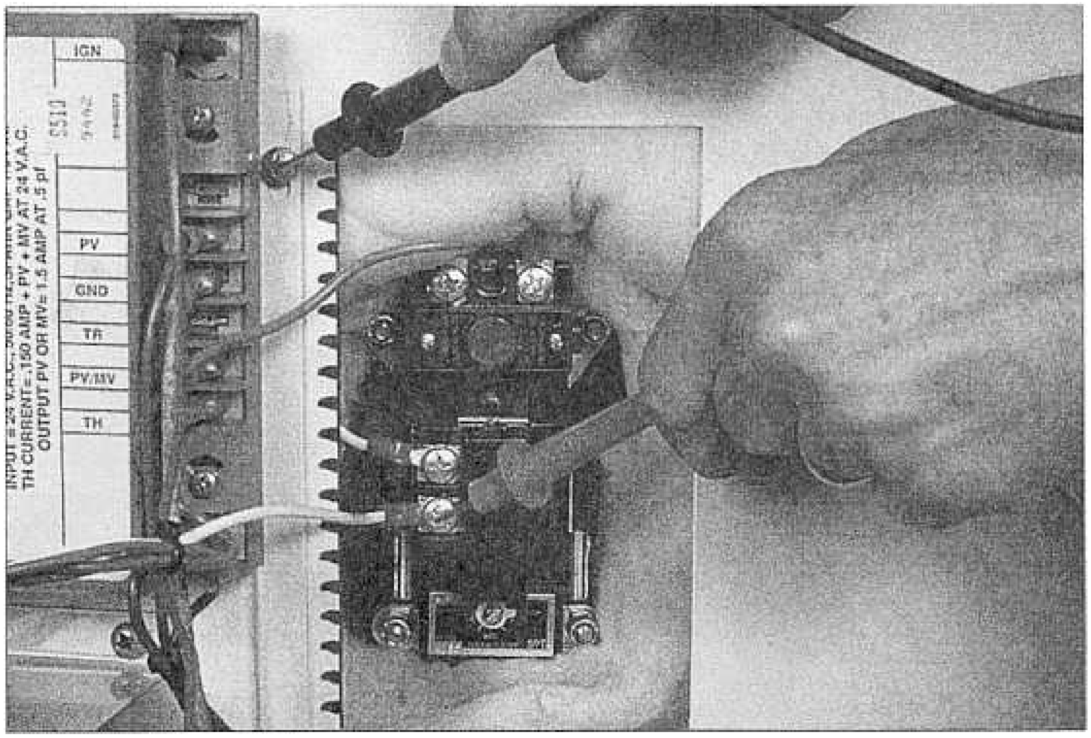
FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.


IGN
PV
GND
TR
PV/MV
TH
TH CURRENT = .150 AMP + PV + MV AT 24 V.A.C.
OUTPUT PV OR MV = 1.5 AMP AT .5 pf

STEP 4

THERMOSTAT TEST

SET UP THE TEST

- Adjust the thermostat to call for heat, then
- using a multimeter, test for 120 VAC at screw on thermostat and ground as shown,
- inspect the wire from thermostat to 4 pin connector for lack of continuity or loose connections, correct either of these conditions if necessary.

RESULTS

If:	then:
the meter does not read 120 VAC ,	replace the thermostat.
the meter does read 120 VAC ,	go to Step 1 of the troubleshooting procedures.

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FPSE 40 and 50 SERVICE AND OPERATION
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY

(NO CALL FOR HEAT)

First make the **Preliminary Checks (see page 45)**, then perform each of the following tests until cause of the failure is determined:

1. **Blower Test**
2. **Cable Test**

PRELIMINARY CHECKS EXCEPTIONS

4. Thermostat should not be calling for heat. (See page 50)

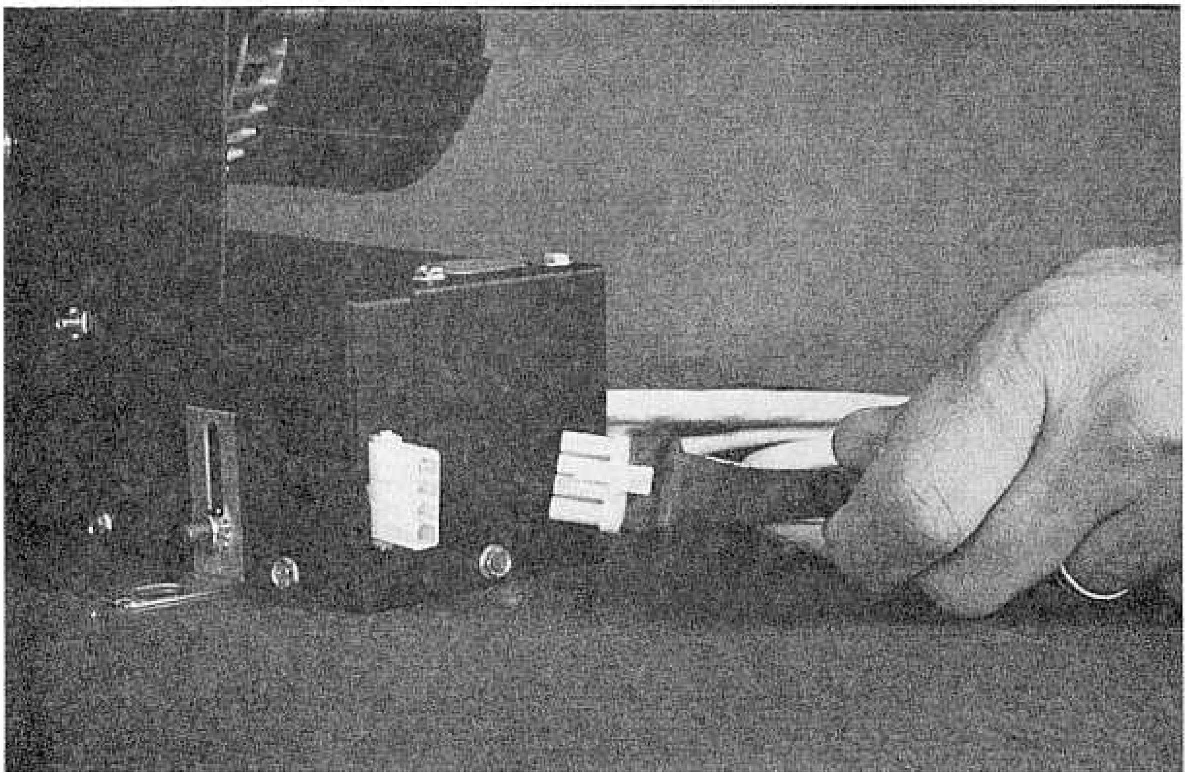
Cautions

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



STEP 1	**BLOWER TEST**
	SET UP THE TEST - Disconnect the 4 wire cable from the blower control box as shown.

RESULTS If:	then:
the blower continues to run,	replace the blower.
the blower stops,	go to Step 2.

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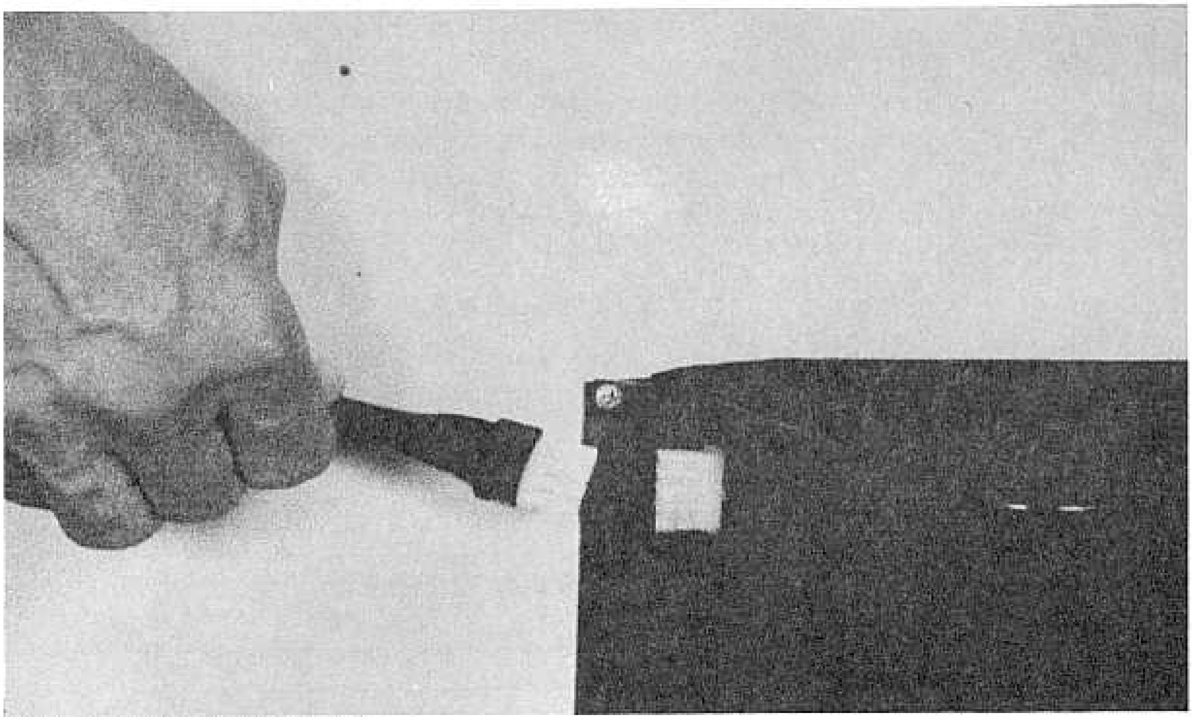
FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



STEP 2	**CABLE TEST**
	SET TEST UP - Reconnect cable to blower control box, then - disconnect cable from receptacle on the door below as shown, - inspect the wire from thermostat to 4 pin connector for lack of continuity or loose connections, correct either of these conditions if necessary.

RESULTS

If:	then:
the blower continues to run,	replace the cable.
the blower stops,	see preliminary checks.

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FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY

(CALLING FOR HEAT, NO PILOT)

First make the **Preliminary Checks (see page 45)**, then perform each of the following tests until cause of the failure is determined:

1. **Air Pressure Switch**
2. **Cable Test**
3. **TH Wire Test**
4. **PV-PV/MV Test**
5. **Spark Test**
6. **Pilot Valve**

PRELIMINARY CHECKS EXCEPTIONS

5. Turn ON\OFF switch off then on again to reset I.I.D. If module locks out (See page 64).

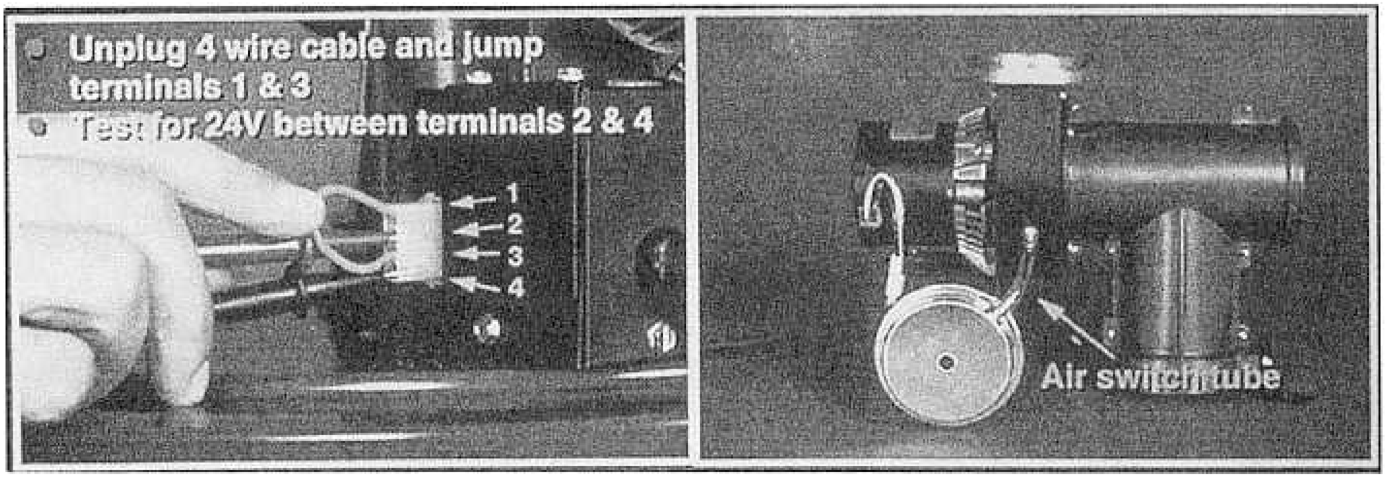
Cautions

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



- Unplug 4 wire cable and jump terminals 1 & 3
- Test for 24V between terminals 2 & 4

STEP 1

AIR PRESSURE SWITCH TEST

SET UP THE TEST

- Disconnect the 4 wire cable from the blower control box,
- using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on the receptacle, then
- using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the pressure switch.
the meter does read 24 VAC,	go to Step 2.

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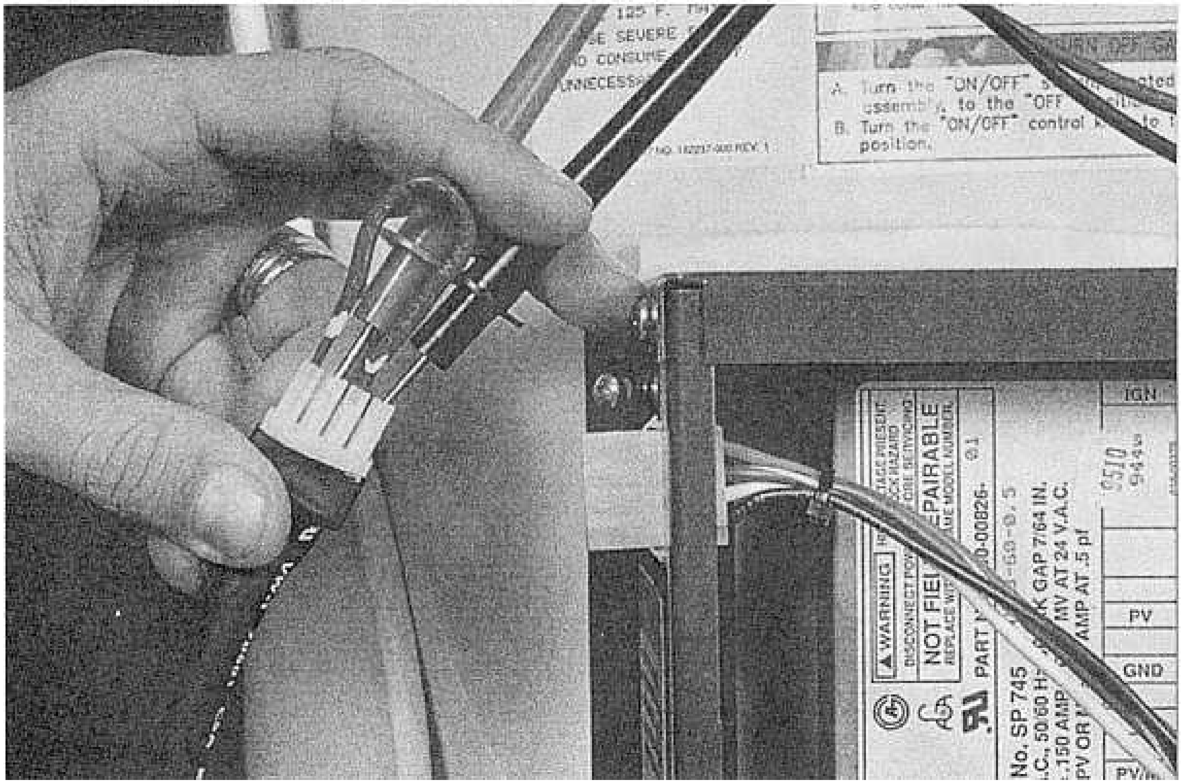
Water Products Co.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 2

CABLE TEST

SET UP THE TEST

- Reconnect the 4 wire cable to the blower control box,
- disconnect the cable from receptacle on door below,
- using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on cable plug, then
- using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the cable.
the meter does read 24 VAC,	go to Step 3

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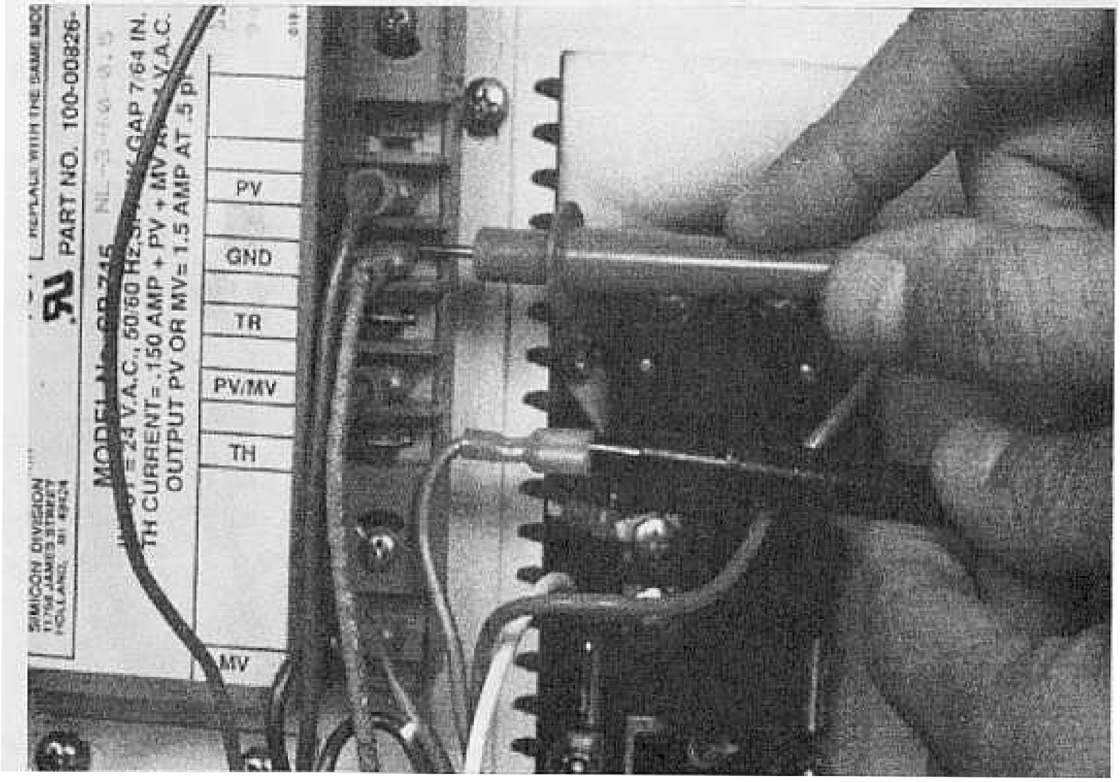
FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.


PART NO. 100-00826-
MODEL NO. DR745
INPUT = 24 V.A.C., 50/60 Hz.
TH CURRENT= .150 AMP + PV + MV
OUTPUT PV OR MV= 1.5 AMP AT .5 pf
SIMICON DIVISION
PV
GND
TR
PV/MV
TH
MV

STEP 3

TH WIRE TEST

SET UP THE TEST

- Reconnect the cable to receptacle on the door,
- remove front cover door,
- inspect the wire from the connector to the I.I.D. for lack of continuity or loose connections, correct any of these conditions if necessary, then
- using a multimeter, test for 24 VAC between TH wire and ground on the I.I.D. as shown.

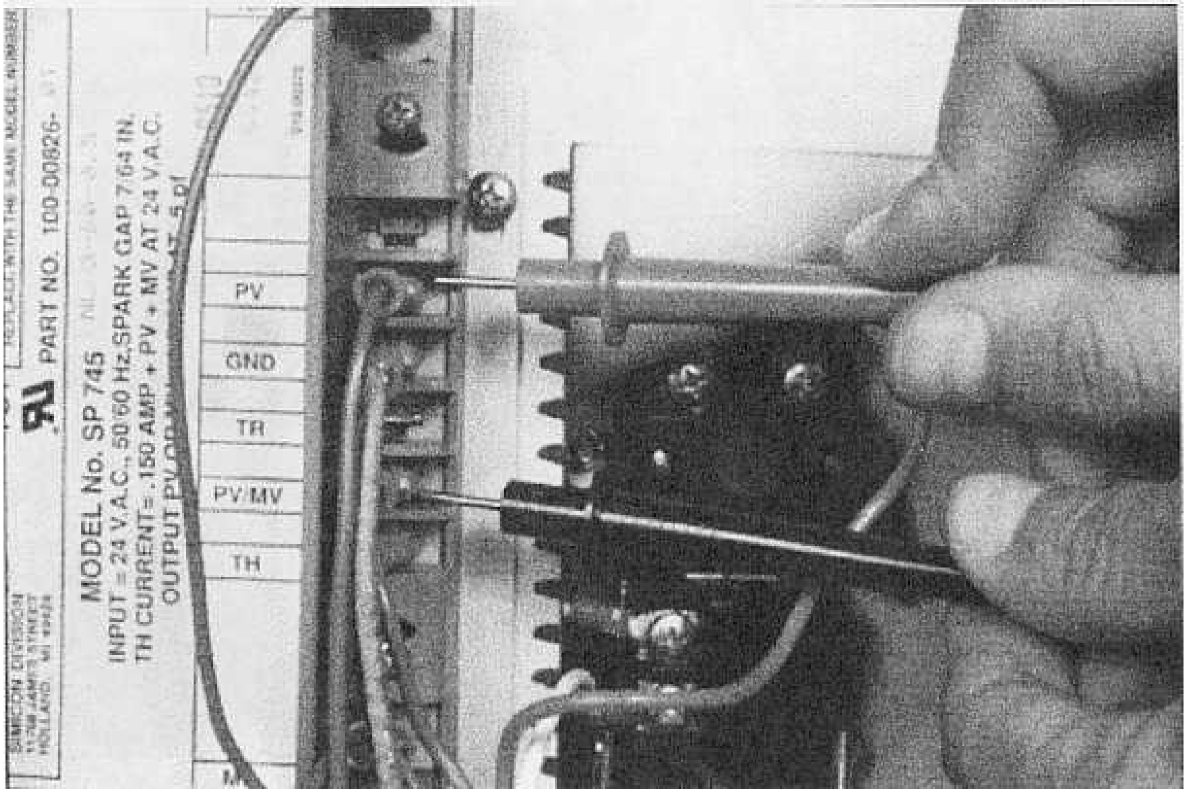
RESULTS

If:	then:
the meter does not read 24 VAC,	replace wire.
the meter does read 24 VAC,	go to Step 4.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.


PART NO. 100-00826-
MODEL No. SP 745
INPUT = 24 V.A.C., 50/60 Hz, SPARK GAP 7/64 IN.
TH CURRENT= .150 AMP + PV + MV AT 24 V.A.C.
PV
GND
TR
PV/MV
TH

STEP 4

PV - PV/MV TEST

SET UP THE TEST
- Reconnect wire to TH terminal to I.I.D.,
- using a multimeter, test for 24 VAC between PV (pilot valve) and PV/MV on the I.I.D. as shown.

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 5.

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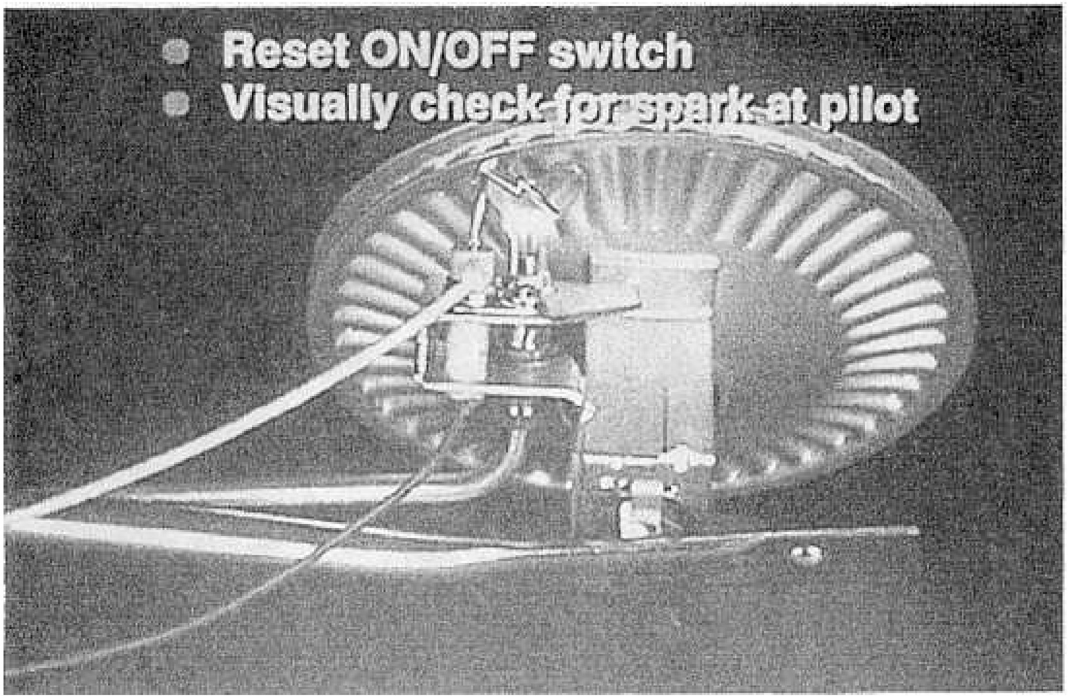
FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



- Reset ON/OFF switch
- Visually check for spark at pilot

STEP 5	**SPARK TEST**
	SET UP THE TEST - Reset the ON/OFF switch, then - visually check for spark at the pilot assembly. - Sparking should stop as soon as pilot is lit. (If sparking continues, see page 64)

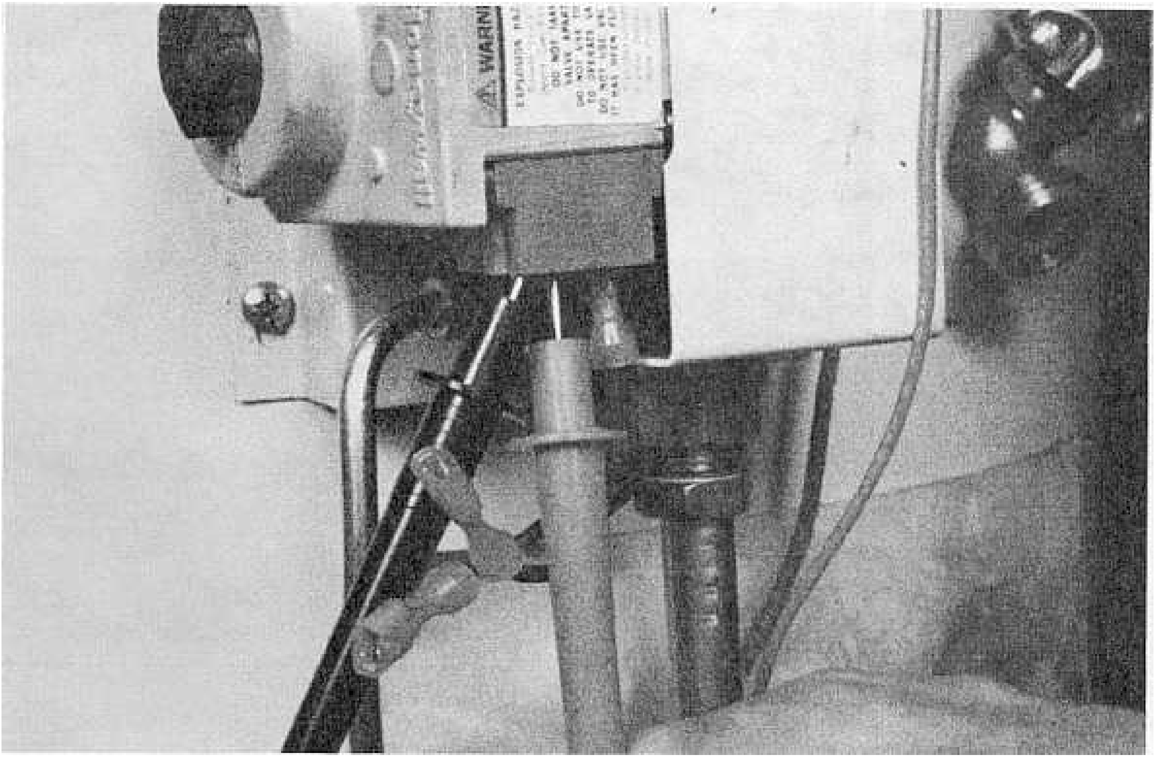
RESULTS

If:	then:
the electrode is not sparking,	- check 7/64" spark gap between pilot hood and electrode. - check spark cable continuity. - check ground cable continuity at I.I.D.
the electrode is sparking,	go to Step 6.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 6	PILOT VALVE TEST
	SET UP THE TEST - Inspect the wire from the I.I.D. to the pilot valve for lack of continuity or loose connections, correct any of these conditions if necessary, - disconnect the wire from the pilot valve, then - using a multimeter, test for continuity at pilot valve as shown. - (If there are other problems with the pilot see page 64)

RESULTS

If:	then:
the meter does not read continuity,	replace pilot valve.
the meter does read continuity,	check gas supply.

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FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

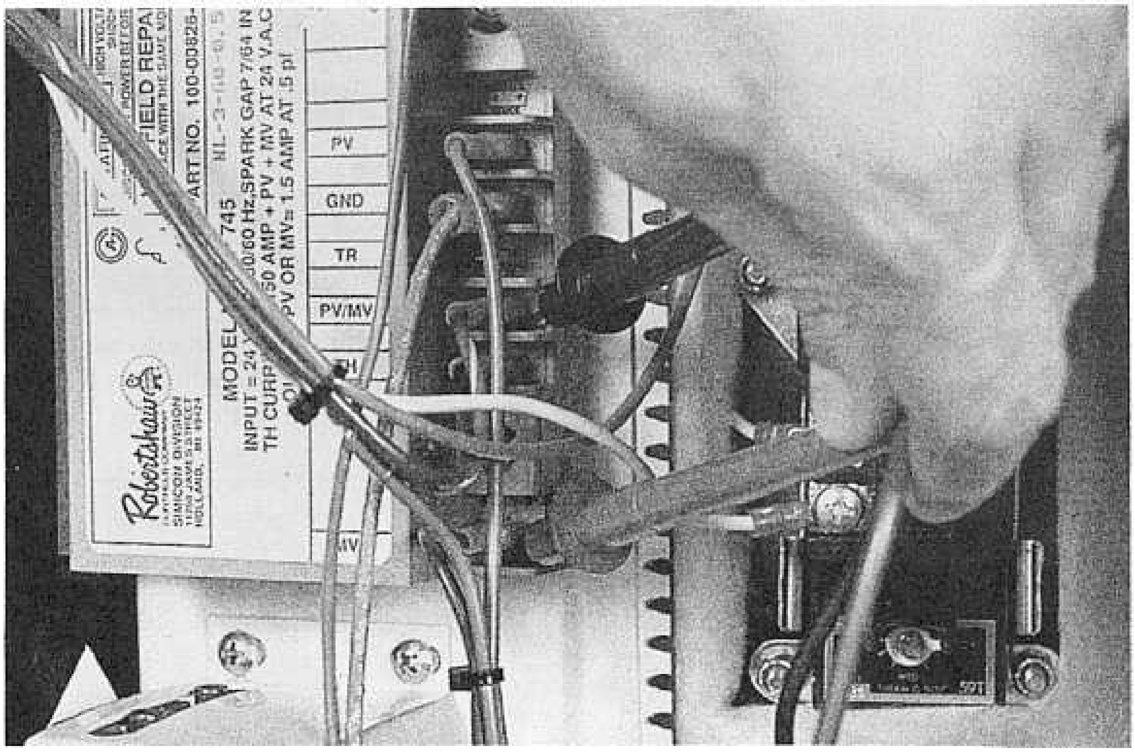
Trouble-shooting cont.	**BLOWER RUNS CONSTANTLY** (CALLING FOR HEAT, PILOT IS LIT, NO MAIN BURNER) First make the **Preliminary Checks (see page 45)**, then perform each of the following tests until cause of the failure is determined: **1. MV-PV/ MV Test** **2. Main Valve**

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.


PV
GND
TR
PV/MV
MV
Robertshaw
MODEL 745
PART NO. 100-03826-
INPUT = 24 V 50/60 Hz, SPARK GAP 7/64 IN
PV OR MV = 1.5 AMP AT .5 pf

STEP 1

MV - PV/MV TEST

SET UP THE TEST

- using a multimeter, test for 24 VAC at MV (main valve) and PV/MV on I.I.D. as shown.

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 2.

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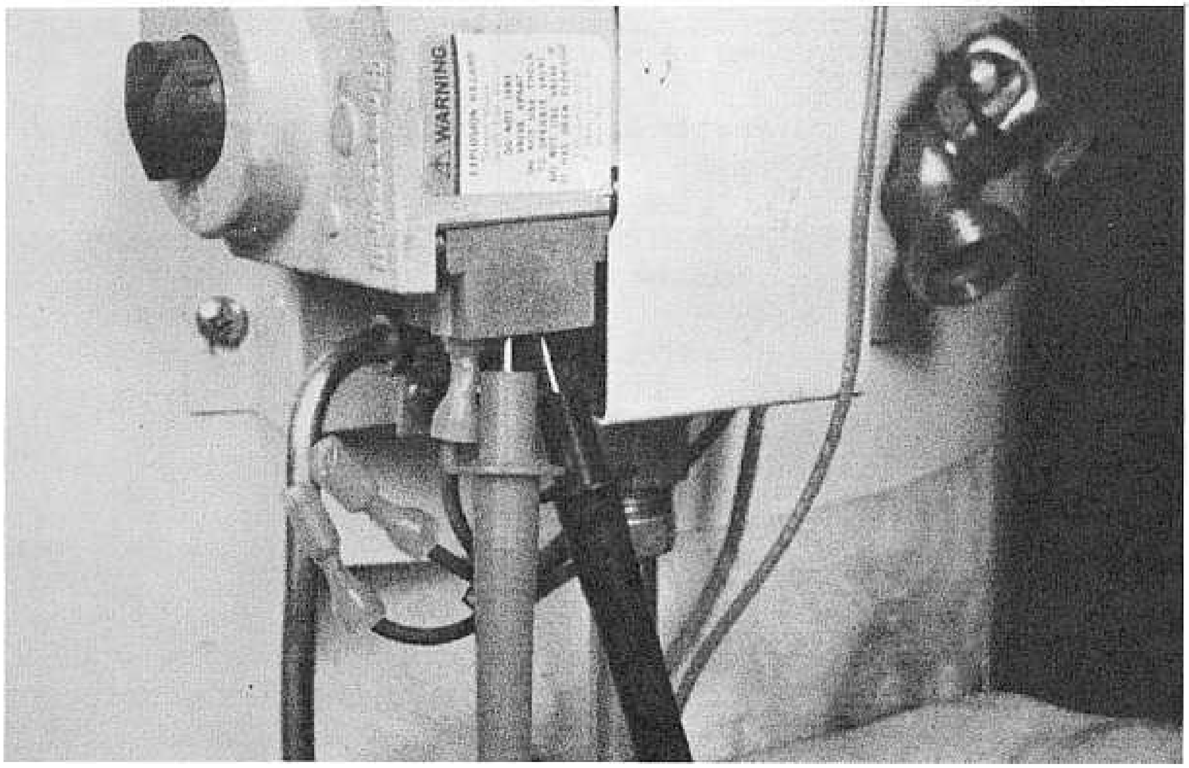
FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.



STEP 2	MAIN VALVE TEST
	SET UP THE TEST - inspect the wire from the I.I.D. to the main valve for lack of continuity or loose connections, correct any of these conditions if necessary, - disconnect the wires from the main valve, then - using a multimeter, test for continuity on main valve as shown. - If there are other problems with the main burner (see page 65)

RESULTS

If:	then:
the meter does not read continuity,	replace main valve.
the meter does read continuity,	check gas supply.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

PILOT PROBLEMS

The following are possible causes of pilot problems:

1. An open E.C.O. (high limit) will not allow the heater to relight. (See page 49)
2. Incorrect pilot gas pressure: it should be 3.5" w.c. for natural gas. It should be 10" w.c. for propane gas.
3. Incorrect excessive equivalent foot length on vents can cause pilot outages.
4. Incorrect pilot position: The pilot should engulf the tip of the flame sensor 3/8" to 1/2".
5. A leak in pilot tube will cause candling.

RESULTS

If:	then:
Any of these reveal a problem,	repair or replace these items, as you would on any standard residential gas water heater.

FPSE 40 and 50 SERVICE AND OPERATION cont.
FPD 40 and 50 SERVICE AND OPERATION cont.

Trouble-shooting cont.

MAIN BURNER PROBLEMS

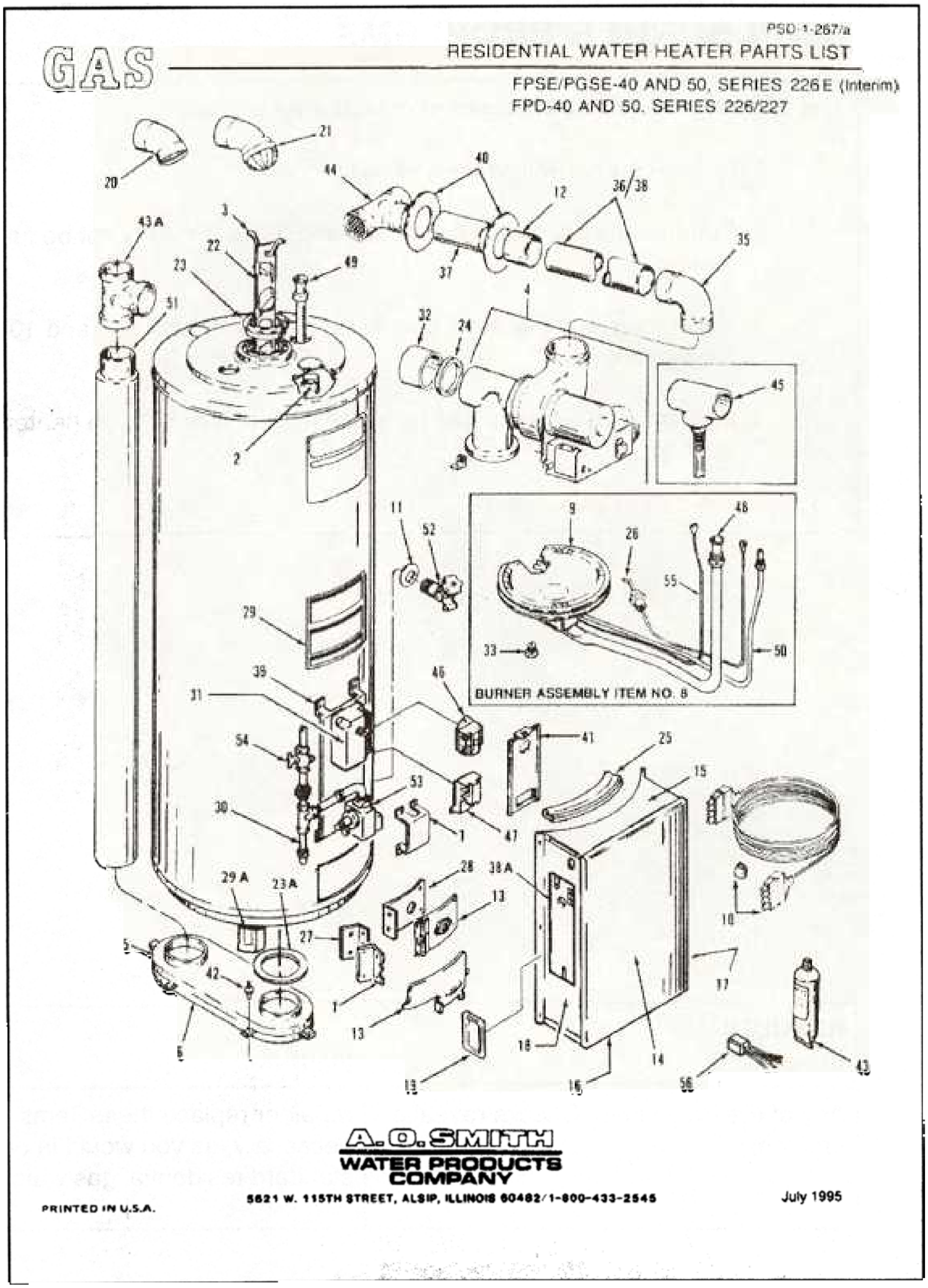
The following are possible causes of main burner problems:

1. Unlevel burner will cause yellow flames.
2. Burning and the orifice indicates main gas valve may not be fully closing.
3. Incorrect gas pressure; it should be 3.5" for natural gas and 10" for propane.
4. Soot build-up. Check gas pressure and air flow through heater and venting.

RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would in on any standard residential gas water heater.

FPSE 40 and 50 PARTS LIST
FPD 40 and 50 PARTS LIST



PSD 1-267/a

GAS

RESIDENTIAL WATER HEATER PARTS LIST

FPSE/PGSE-40 AND 50, SERIES 226E (Interim)
FPD-40 AND 50, SERIES 226/227

21
20
44
40
12
36/38
3
43 A
22
23
49
37
35
51
4
32
24
45
2
11
52
9
48
26
55
79
33
50
BURNER ASSEMBLY ITEM NO. 8
39
31
46
41
25
54
53
15
30
1
47
29 A
23 A
28
38 A
13
10
5
27
42
1
13
17
6
18
14
43
19
16
56

A.O. SMITH
WATER PRODUCTS COMPANY
5621 W. 115TH STREET, ALSIP, ILLINOIS 60482/1-800-433-2545

July 1995

PRINTED IN U.S.A.

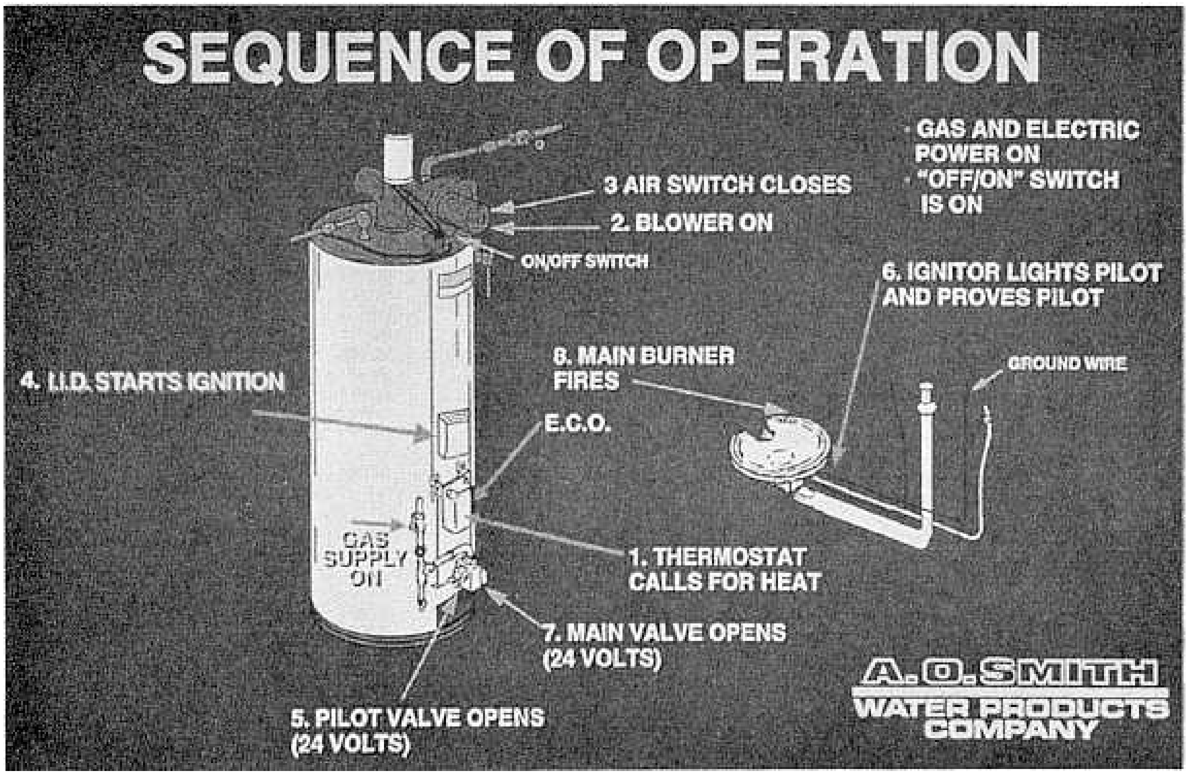
Item	Description	Series 222/223		Series 226/227	
		FPSE-40 PGSE-40	FPSE-50 PGSE-50	FPD-40	FPD-50
1	Angle, Door Left	----	----	181450	181450
2	Anode	43816-38	43816-38	43817-29	43817-35
3	Baffle, Hanger	181360	181360	181360	181360
4	Blower, Assembly	181616	181616	181843	181843
5	Box Top, Lower Air Supply	----	----	181489	181489
6	Box Bottom, Lower Air Supply	----	----	181490	181490
7	Bracket, Gas Valve	181709	181709	181898	181898
7	Bracket, Gas Valve, Series 227 Only	----	----	182194	182194
8	Burner, Assembly				
	Natural Gas	181732	181732-2	181732-12	181732-14
	Propane Gas	181732-1	181732-3	181732-12	181732-14
9	Burner with Pilot				
	Natural Gas	181726	181726	181726	181726
	Propane Gas	181726-1	181726-1	181726-1	181726-1
10	Cable, Control w/Clips	181728	181728	181728	181728
11	Collar, Pipe	20172-14	20172-14	20172-14	20172-14
12	Coupling	181543	181543	----	----
13	Door, Inner	180596	180596	181449	181449
14	Door Panel, Cover	181708	181708	181943	181943
15	Door Panel, Top	181857	181857	181942	181942
16	Door Panel, Bottom	181858	181858	181941	181941
17	Door Panel, Right	181859	181859	181940	181940
18	Door Panel, Left	181860	181860	181939	181939
19	Door-Plug, Outer	181733	181733	----	----
20	Elbow Assembly, Exhaust, FPD Only	----	----	181528	181528
21	Elbow Assembly, Intake, FPD Only	----	----	182167	182167
22	Flue, Baffle	181382	181382	181382	181382
23	Flue, Restrictor	34894	34894	34894	34894
23A	Gasket, Fiberglass	----	----	182130	182130
24	Gasket, Inlet Tee, FPD Only	----	----	181765	181765
25	Grommet, Outer Door	181764	181764	181764-1	181764-1
26	Igniter	181734	181734	181903	181903
27	Insulation, Angle	----	----	182132	182132
28	Insulation, Door	----	----	182131	182131
29	Label-Lighting & Operating	181719	181719	182065	182065
29A	Leg, 3 Required	----	----	38046	38046
30	Leg, Dirt Assembly, Propane Gas	43761	43761	43761	43761
31	Module, Ignition	181723	181723	181723	181723
32	Orifice, Air Flow, FPD Only	----	----	181773	181773
33	Orifice, Main Burner				
	Natural Gas	181508-123	181508-123	181508-031	181508-031
	Propane Gas	181628-50	181628-50	181791-50	181791-50
34	Orifice, Pilot				
	Natural Gas	180814	180814	180814	180814
	Propane Gas	180824	180824	180824	180824
35	Pipe, P.V.C. 90° Elbow	181530	181530	----	----
36	Pipe, P.V.C. 3" x 48" Length	181531-1	181531-1	----	----
37	Pipe, P.V.C. 3" x 7" Length	----	----	181837	181837
38	Pipe, P.V.C. 3" x 12" Length	----	----	181531	181531
38A	Plate, Cover	----	----	181938	181938
39	Plate, Mounting	181615	181615	181944	181944
40	Plate, Wall	181557	181557	181557	181557
41	Protector, Personnel	181758	181758	181758	181758
42	Rivet	----	----	181625	181625
43	* Sealer, Tube High Temp. Silicone Sealant	181564	181564	181564	181564
43A	Tee, P.V.C. - 3"	----	----	181762	181762
44	Tee Assembly, Exhaust, FPSE, PGSE Only	181617	181617	----	----
45	Tee Assembly, Condensate	181861	181861	181861	181861
46	E.C.O.	181706	181706	181706	181706
47	Thermostat	181705	181705	181705	181705
48	Tube, Burner:				
	Natural Gas	181482-6	181482-7	181482-11	181482-12
	Propane Gas	181482-6	181482-7	181792-11	181792-12
49	Tube, Inlet	21067-33	21067-33	160374-28	160374-28
50	Tube, Pilot	23330	23330	23330	23330
51	Tube, Rear Air Supply	----	----	181772	181772-1
52	Valve, Drain	26273-6	26273-6	42037	42037-1
53	Valve, Gas:				
	Natural Gas	181721	181721	181950	181950
	Propane Gas	181722	181722	182192	182192
54	Valve, Main Gas Shutoff	181737	181737	181737	181737
55	Wire, Ground	181736	181736	181736-2	181736-2
56	Wire, Harness	181609	181609	181952	181952

* Sealant must conform to MIL-A-46106A, type 1/FDA21 CFR 175.300. Must be able to withstand constant high temperature of 450°F and a low of -75°F. Equal to National Polymer Products, Sealcon II

FPS 75 SERVICE AND OPERATION

Service & Operation Introduction

Most problems will first appear as blower malfunctions; either a blower that does not run or a blower that runs constantly. In these instances, further trouble shooting is required to determine the exact cause. Familiarize yourself with the sequence of operation, study the wiring diagram, and complete the preliminary checks, then if those are OK, go to the section of this workbook that applies to the condition and follow the tests.

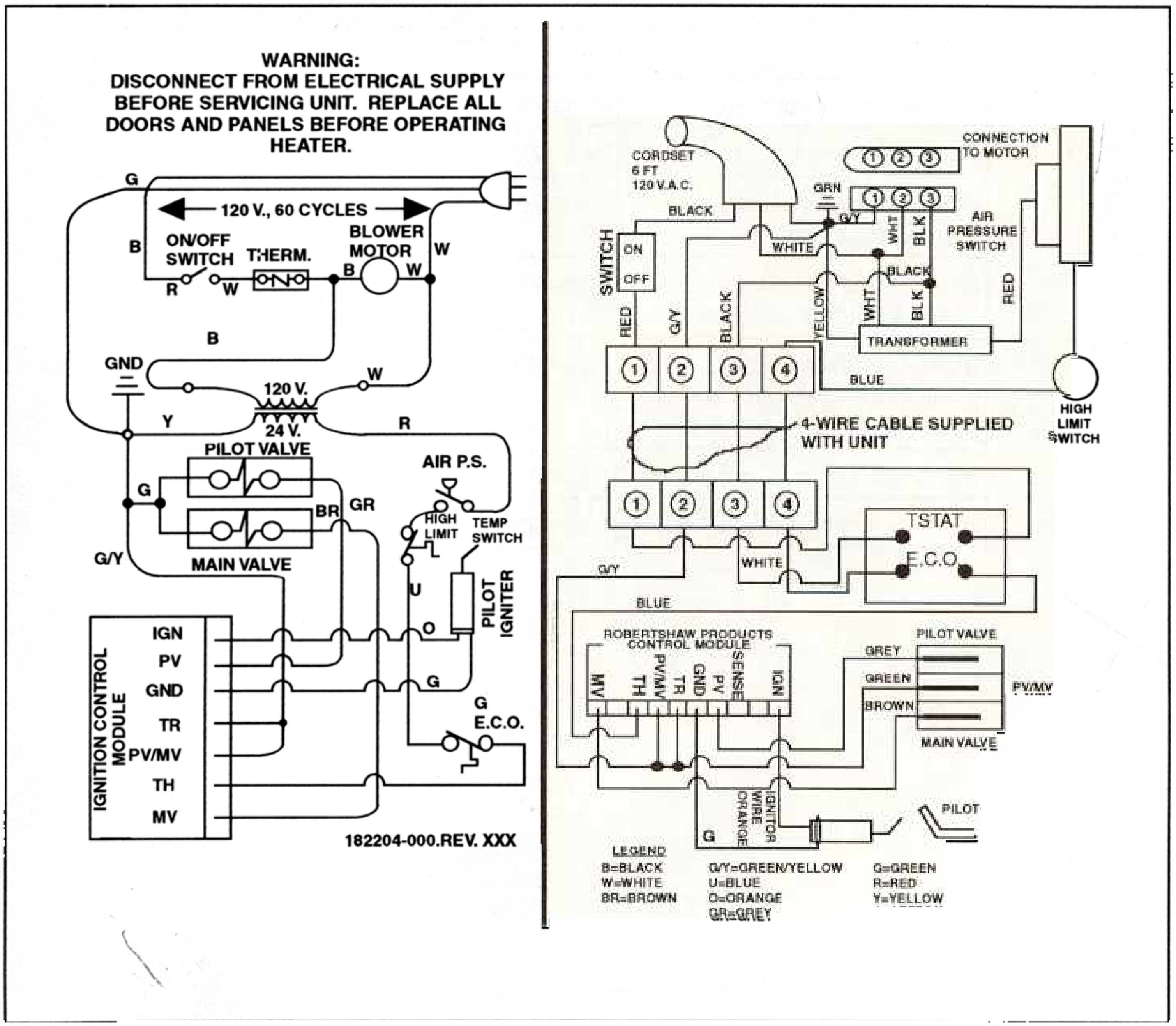

SEQUENCE OF OPERATION
GAS AND ELECTRIC POWER ON
"OFF/ON" SWITCH IS ON
3 AIR SWITCH CLOSES
2. BLOWER ON
ON/OFF SWITCH
6. IGNITOR LIGHTS PILOT AND PROVES PILOT
GROUND WIRE
8. MAIN BURNER FIRES
4. I.I.D. STARTS IGNITION
E.C.O.
GAS SUPPLY ON
1. THERMOSTAT CALLS FOR HEAT
7. MAIN VALVE OPENS (24 VOLTS)
5. PILOT VALVE OPENS (24 VOLTS)
A.O. SMITH WATER PRODUCTS COMPANY

Sequence of Operation

1 Thermostat calls for heat,
2 Blower activates,
3 Air pressure switch closes,
4 Ignition starts,
5 Pilot valve opens,
6 Ignitor lights pilot and proves pilot,
7 Main valve opens,
8 Main burner ignites.

FPS 75 SERVICE AND OPERATION cont.

Wiring Diagram	This wiring diagram only applies to model FPS 75 series 230 - 233.


WARNING:
DISCONNECT FROM ELECTRICAL SUPPLY BEFORE SERVICING UNIT. REPLACE ALL DOORS AND PANELS BEFORE OPERATING HEATER.
G
120 V., 60 CYCLES
B
ON/OFF SWITCH
THERM.
BLOWER MOTOR
W
R
W
B
W
B
GND
120 V.
W
Y
24 V.
R
PILOT VALVE
AIR P.S.
G
BR
GR
HIGH LIMIT
TEMP SWITCH
G/Y
MAIN VALVE
U
PILOT IGNITER
O
IGNITION CONTROL MODULE
IGN
PV
GND
TR
PV/MV
TH
MV
G
G
E.C.O.
182204-000.REV. XXX
CORDSET
6 FT
120 V.A.C.
CONNECTION TO MOTOR
① ② ③
GRN
① ② ③
BLACK
G/Y
SWITCH
ON
OFF
WHITE
WHT
BLK
AIR PRESSURE SWITCH
BLACK
RED
G/Y
BLACK
YELLOW
WHT
BLK
RED
TRANSFORMER
① ② ③ ④
BLUE
HIGH LIMIT SWITCH
4-WIRE CABLE SUPPLIED WITH UNIT
① ② ③ ④
TSTAT
E.C.O
G/Y
WHITE
BLUE
ROBERTSHAW PRODUCTS CONTROL MODULE
MV
TH
PV/MV
TR
GND
PV
SENSE
IGN
PILOT VALVE
GREY
GREEN
BROWN
PV/MV
MAIN VALVE
IGNITOR WIRE ORANGE
G
PILOT
LEGEND
B=BLACK
W=WHITE
BR=BROWN
G/Y=GREEN/YELLOW
U=BLUE
O=ORANGE
GR=GREY
G=GREEN
R=RED
Y=YELLOW

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FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting	To troubleshoot the FPS you must understand its sequence of operation. Review that section if necessary. In addition, installation problems can cause the heater to malfunction. Review sections on venting and checking draft. Most problems with the heater will first appear as blower malfunctions.

Subject	**Page**
Preliminary Checks	Page 71
Blower does not run	Page 72
Blower runs constantly (No call for heat)	Page 76
Blower runs constantly (Calling for heat, no pilot)	Page 79
Blower runs constantly (Calling for heat, pilot is lit, main burner)	Page 89
Pilot Problems	Page 92
Main Burner Problems	Page 93

FPS 75 SERVICE AND OPERATION cont

Trouble-shooting cont.

PRELIMINARY CHECKS

1. Gas valve knob is in ON position
2. 120 VAC is supplied to heater
3. Thermostat is calling for heat
4. Blower ON/OFF switch is in the ON position
5. Connection between blower motor and blower control box is secure

RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would on any standard residential gas water heater.

Cautions

When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

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FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.	**BLOWER DOES NOT RUN** First make the **Preliminary Checks (see page 71),** then perform each of the following tests until cause of the failure is determined: **1. Blower Test** **2. Cable Test** **3. Thermostat Test**

Cautions	When performing the following troubleshooting procedures you will be required to jump out parts of the electrical circuit. Turn the switch on the blower off when inserting the jumper wire. Then turn the switch back on. Use **extreme caution** as you may be working with 120 VAC.

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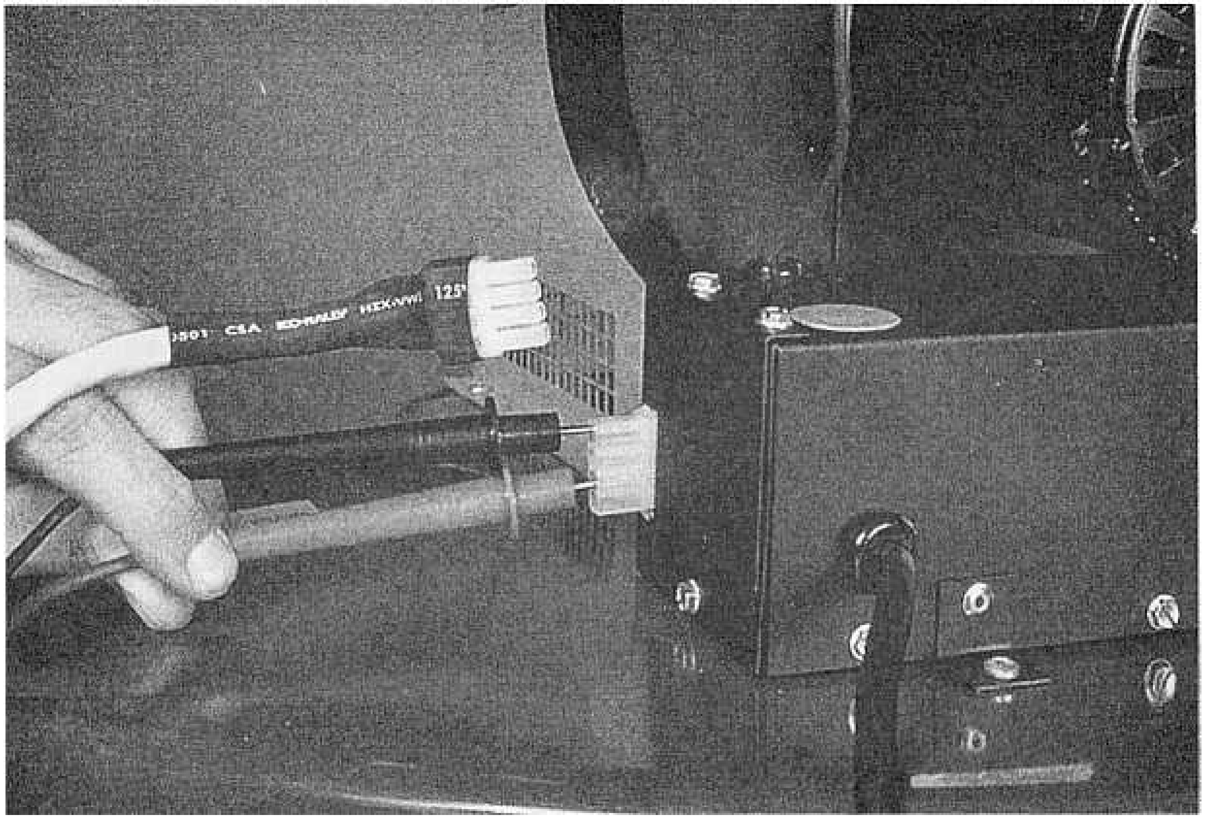
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 1	**BLOWER TEST**
	SET UP THE TEST - Disconnect the 4 wire cable from the blower control box, then - using a multimeter, test for 120 VAC between pins 1 and 3 on the control box receptacle as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace the blower assembly.
the meter does read 120 VAC,	go to Step 2.

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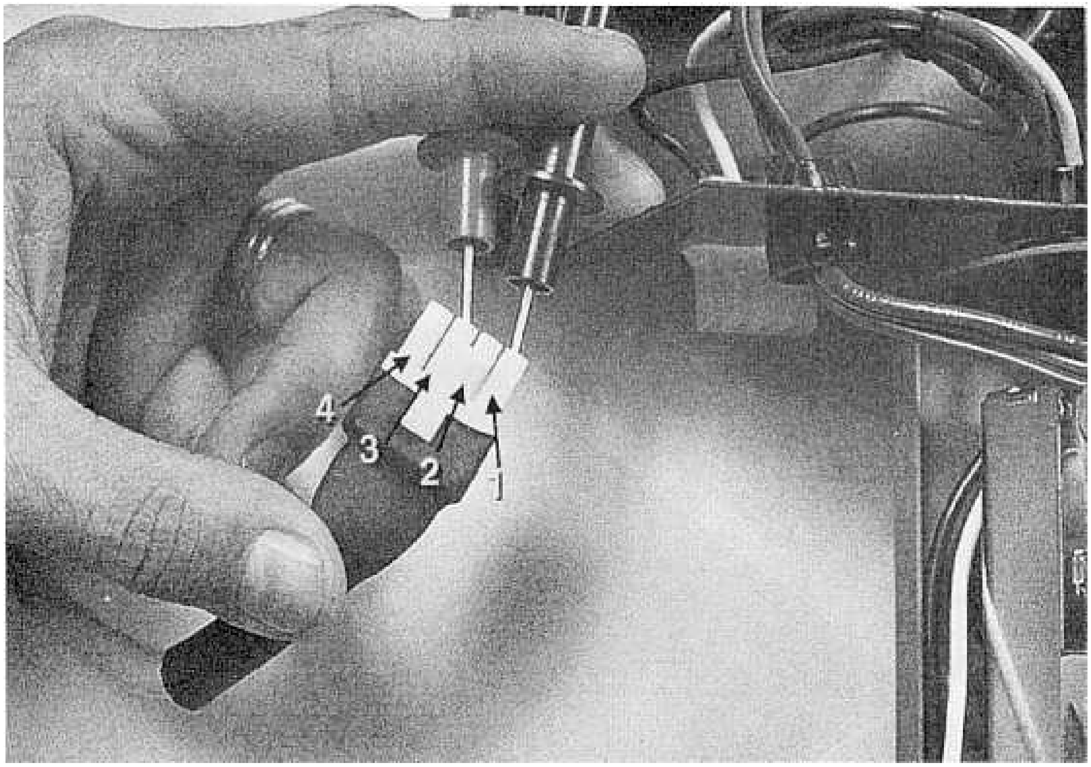
Water Products Co.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 2	**CABLE TEST**
	SET TEST UP - Reconnect cable to blower control box, - disconnect cable from door receptacle below, then - using a multimeter, test for 120 VAC between pins 1 and 3 on the cable plug as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace the cable.
the meter does reads 120 VAC,	go to step 3.

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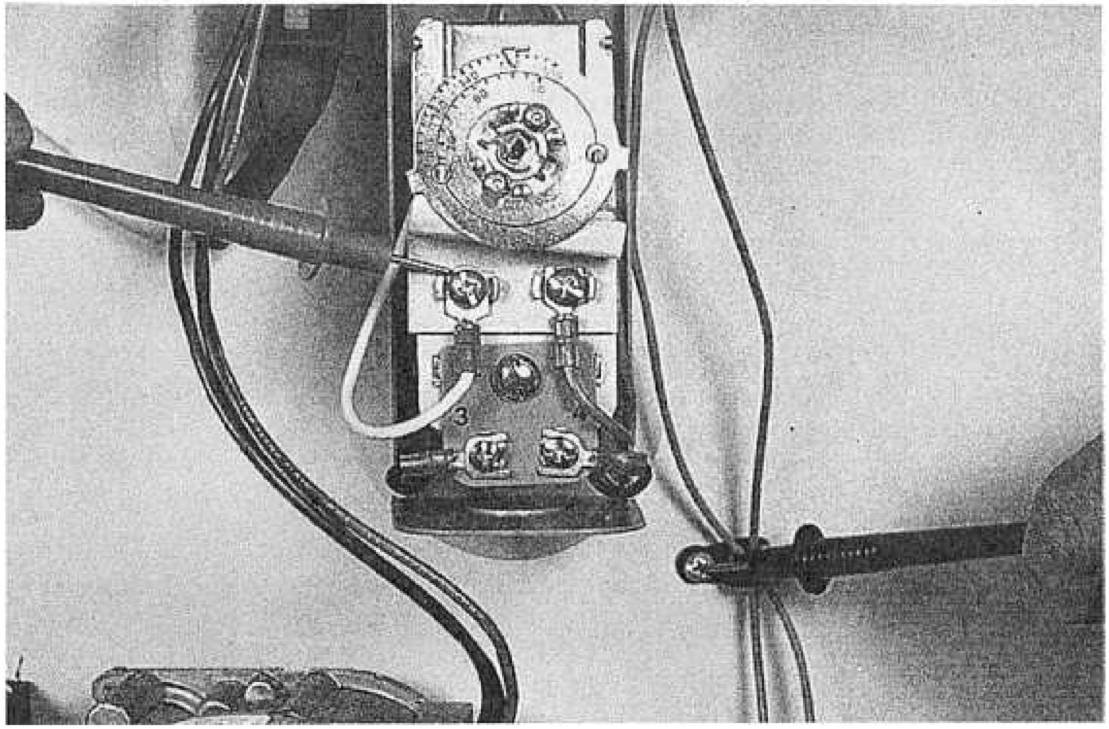
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER DOES NOT RUN cont.



STEP 3

THERMOSTAT TEST

SET UP THE TEST

- Reconnect cable to door receptacle,
- Adjust the thermostat to call for heat, then
- using a multimeter, test for 120 VAC at screw on thermostat and ground as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace the thermostat.
the meter does read 120 VAC,	go to preliminary checks.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY

(NO CALL FOR HEAT)

First make the **Preliminary Checks (see page 71)** then perform each of the following tests until cause of the failure is determined:

1. Blower Test
2. Cable Test

PRELIMINARY CHECKS EXCEPTIONS

4. Heater should be calling for heat.

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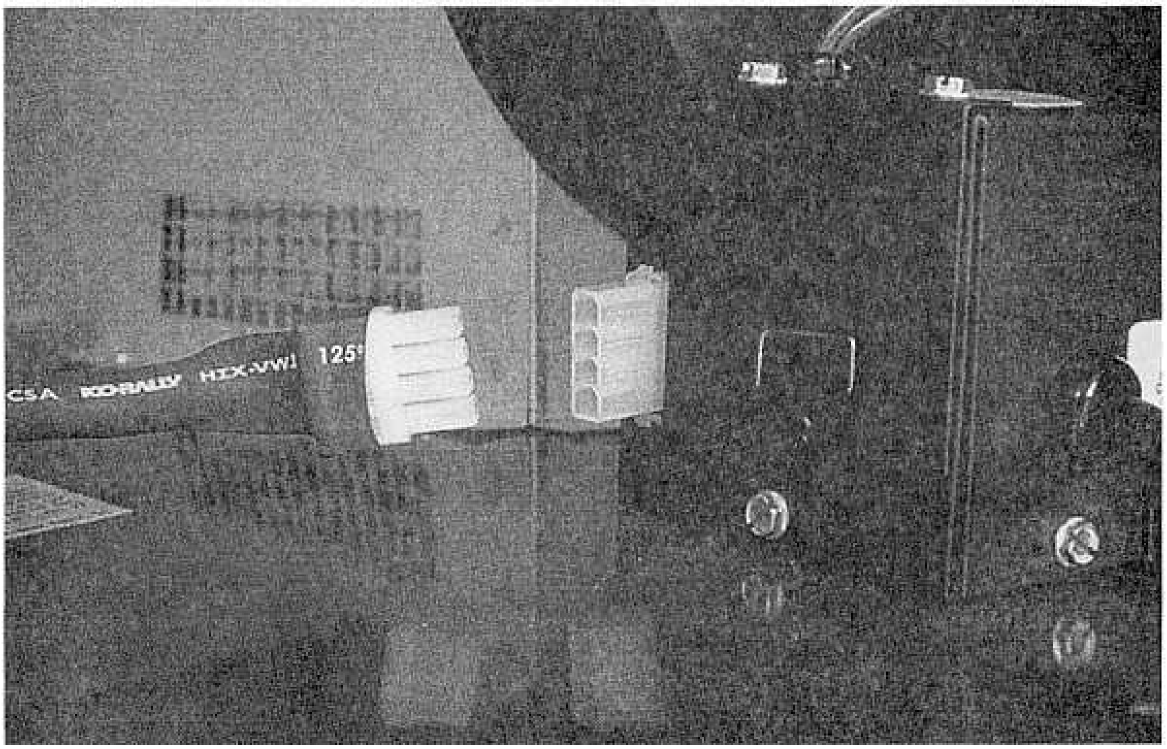
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



S T 1 E P	**BLOWER TEST** **SET UP THE TEST** - Disconnect the 4 wire cable from the blower control box.

RESULTS If:	then:
the blower continues to run,	replace the blower.
the blower stops,	go to Step 2.

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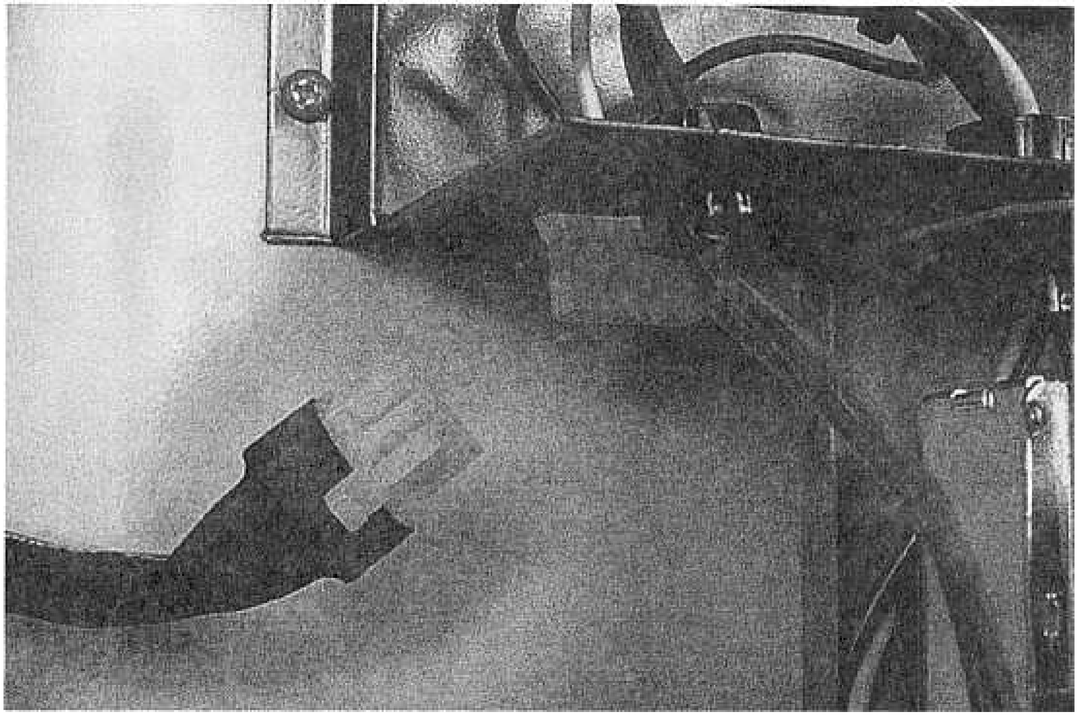
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (No call for heat) cont.



STEP 2	**CABLE TEST**
	SET TEST UP - Reconnect cable to blower control box, then - disconnect cable from receptacle on door below as shown.

RESULTS

If:	then:
the blower continues to run,	replace the cable.
the blower stops,	see preliminary checks.

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FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY

(CALLING FOR HEAT, NO PILOT)

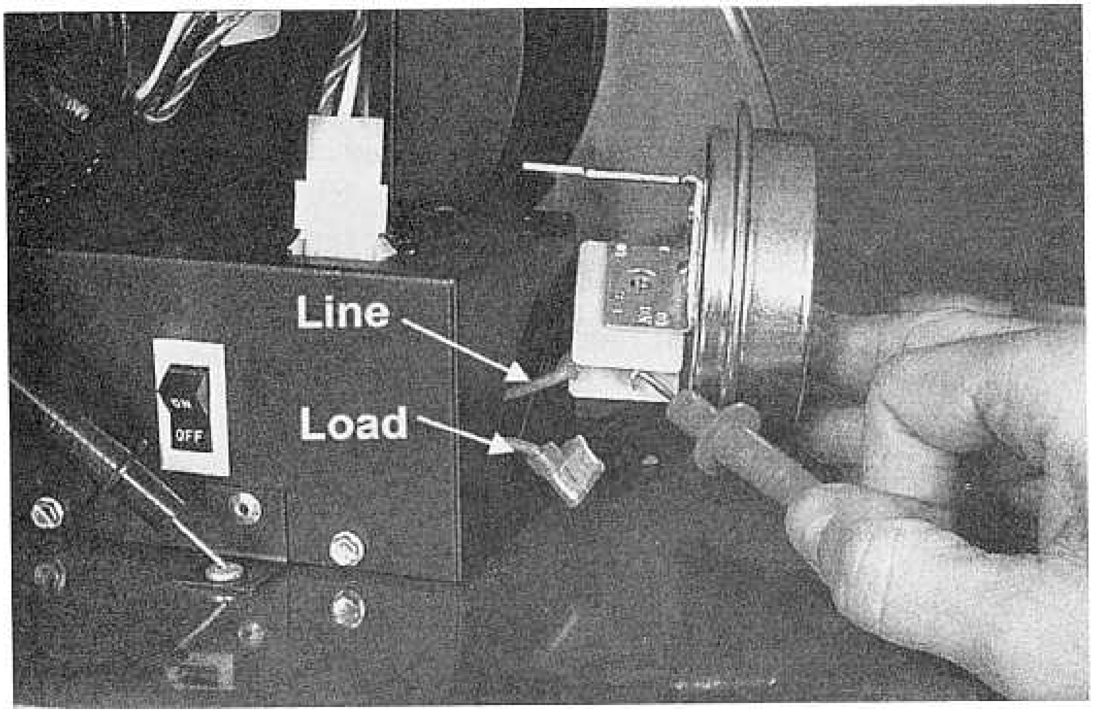
First make the **Preliminary Checks (see page 71)** then perform each of the following tests until cause of the failure is determined:

1. **Air Pressure Switch Test**
2. **Vent High Limit Test**
3. **Blower Test**
4. **Cable Test**
5. **High Limit Test**
6. **TH Wire Test**
7. **PV - MV/PV Test**
8. **Spark Test**
9. **Pilot Solenoid Test**

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 1	AIR PRESSURE SWITCH TEST
	SET UP THE TEST - Remove the air pressure switch from control box leaving wires attached, - remove load wire from air pressure switch, - using a multimeter, test for 24 VAC between the terminal and ground as shown. - There are several reasons the air pressure switch may not be making (See pages 10, 11, 12, 17, 18)

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the air pressure switch.
the meter does read 24 VAC,	go to Step 2.

Line=24 VAC supply
Load=Wire carrying current onto high limit

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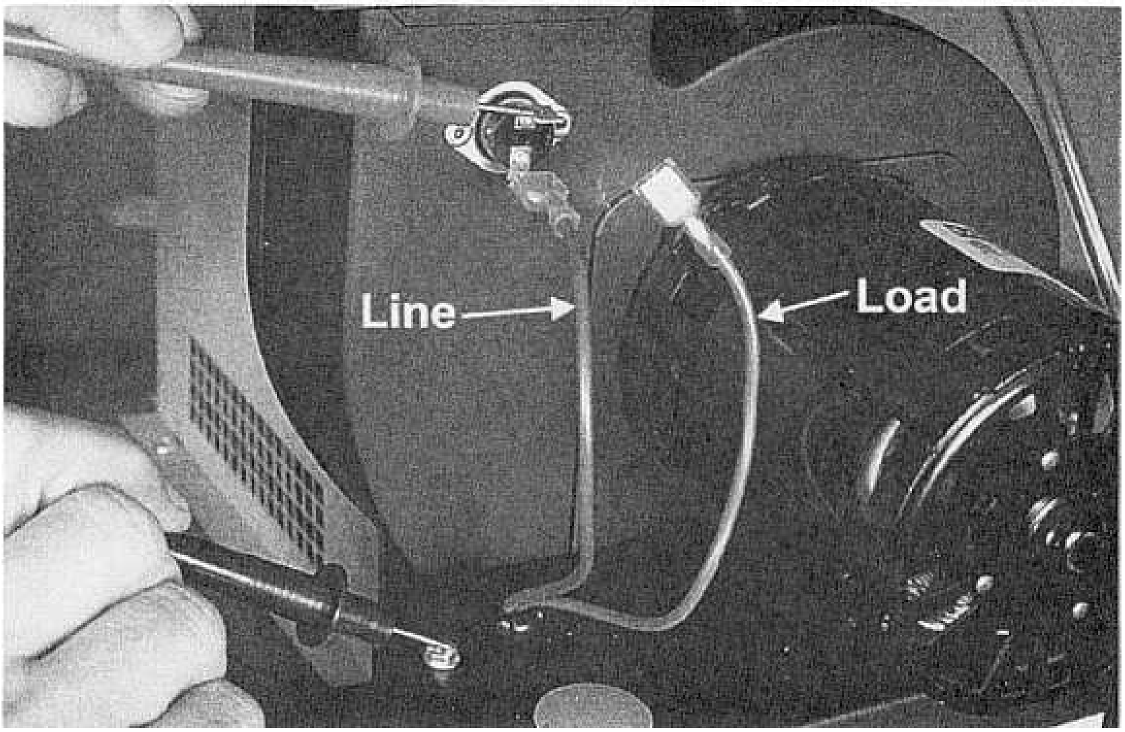
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 2

VENT HIGH LIMIT TEST

SET UP THE TEST

- Reconnect the air pressure switch,
- disconnect the load wire from the vent high limit, then
- using a multimeter, test for 24 VAC between wire and ground as shown.
- Vent high limit may have shut the heater down due to excessive temperature. See pages 10, 11, 12, 17, 18)

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the vent high limit.
the meter does read 24 VAC,	go to Step 3.

Line=24 VAC supply
Load=Wire carrying current onto connector

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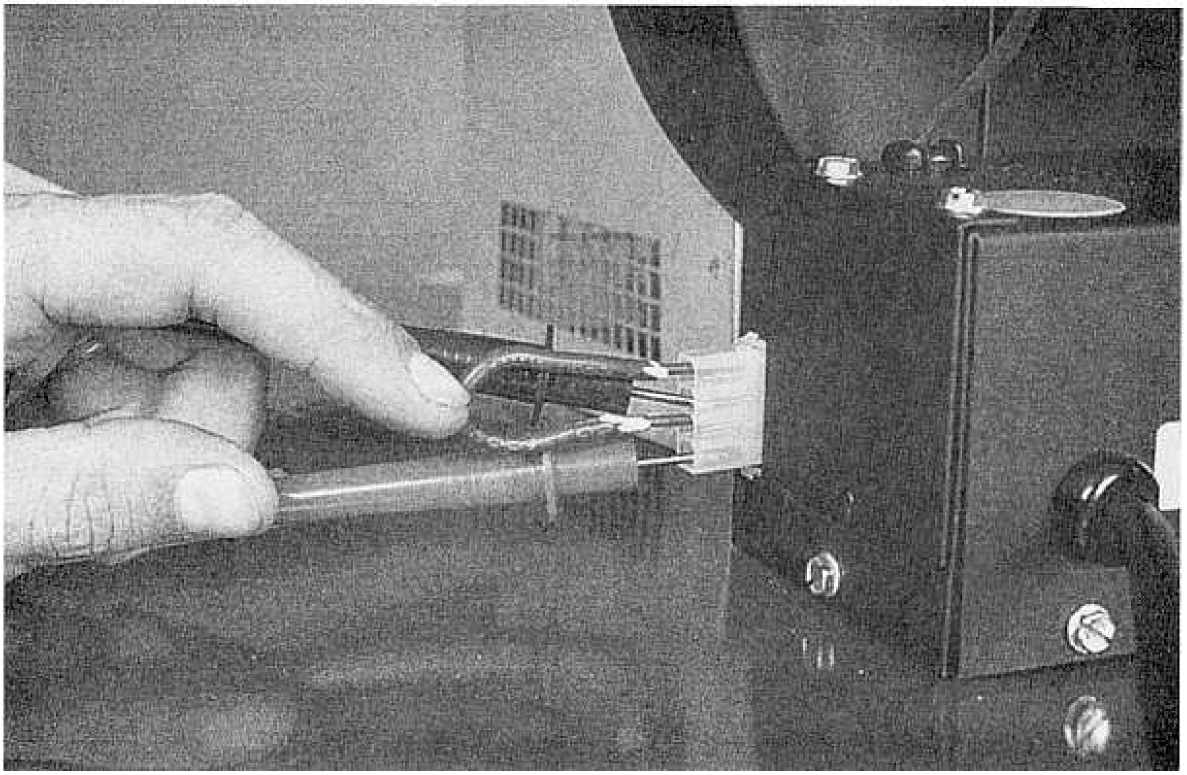
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 3	**BLOWER TEST**
	SET UP THE TEST - Reconnect the wire to vent high limit, - disconnect the 4 wire cable from the blower control box, - using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on plug receptacle, then - using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the blower.
the meter does read 24 VAC,	go to Step 4.

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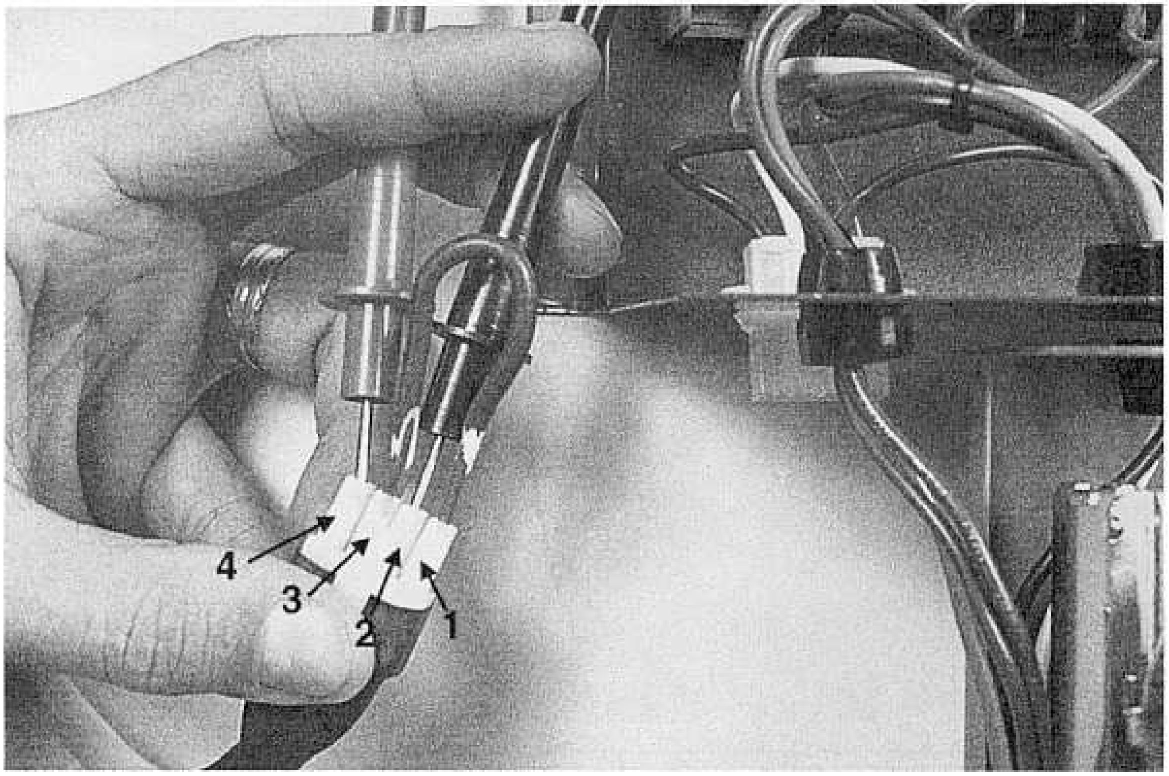
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 4	**CABLE TEST**
	SET UP THE TEST - Reconnect the 4 wire cable to the blower control box, - disconnect the cable from receptacle on door below, - using an insulated jumper wire, jump between pins 1 and 3 (caution 120 VAC) on cable plug , then - using a multimeter, test for 24 VAC between pins 2 and 4 as shown.

RESULTS

If:	then:
the meter does not read 24 VAC,	replace the cable.
the meter does read 24 VAC,	go to Step 5.

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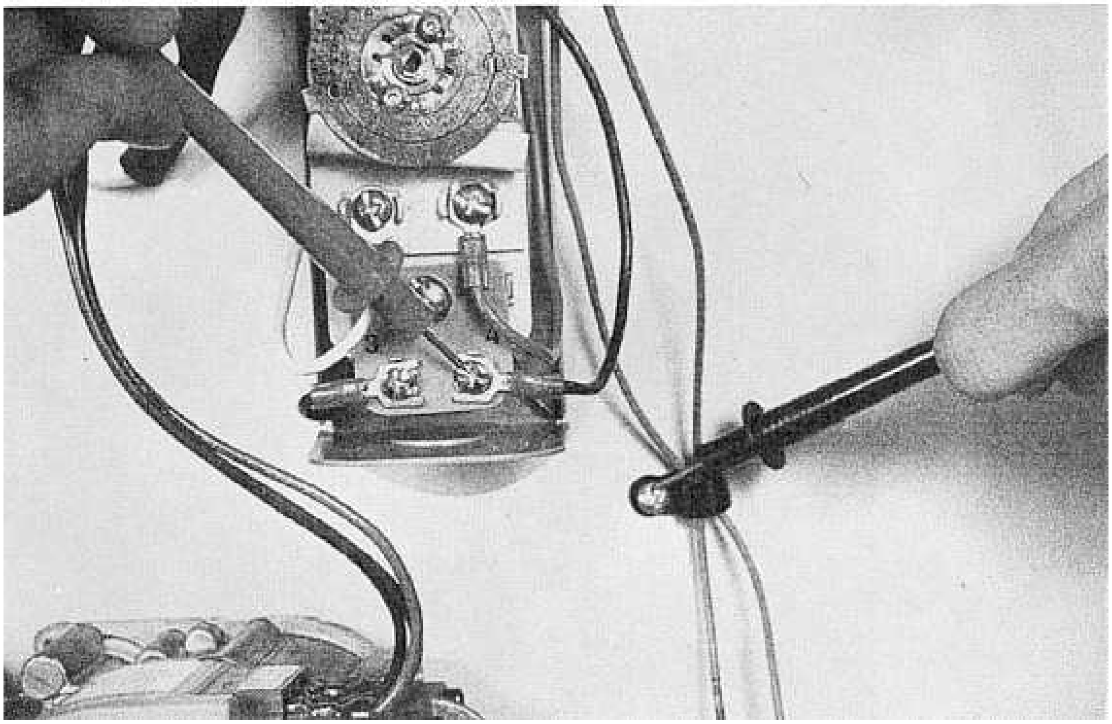
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



S T E P 5

HIGH LIMIT TEST

SET UP THE TEST

- Reconnect the cable to receptacle on the door,
- remove covers from door and thermostat,
- inspect wire between connector and high limit for lack of continuity or loose connections, correct either of these conditions if necessary,
- remove one of the wires from the high limit, then
- using a multimeter, test for 24 VAC at screw on high limit and ground as shown.

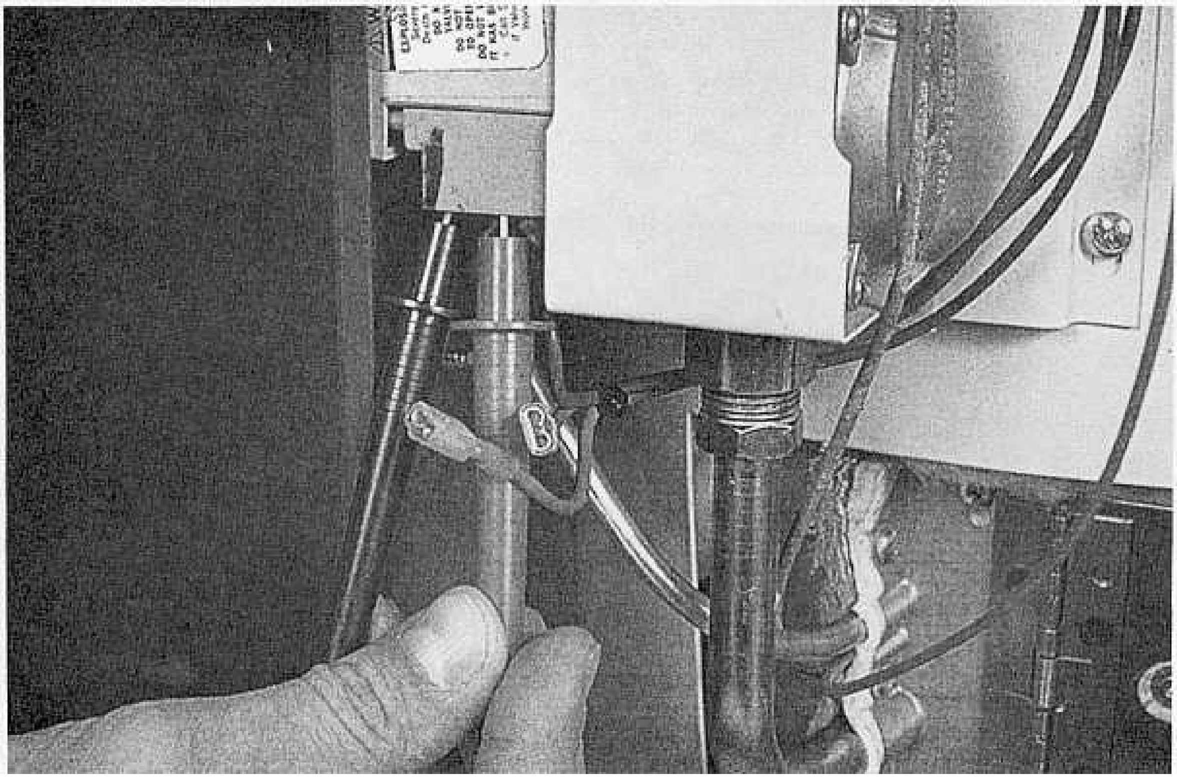
RESULTS

If:	then:
the meter does not read 24 VAC,	replace high limit.
the meter does read 24 VAC,	go to Step 6.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 6	TH WIRE TEST
	SET UP THE TEST - Reconnect the wire to high limit, - inspect wire between high limit and I.I.D. for lack of continuity or loose connections, correct either of these conditions if necessary, then - using a multimeter, test for 24 VAC at TH wire on the I.I.D. and ground as shown.

RESULTS

If:	then:
the meter does not read 120 VAC,	replace wire.
the meter does read 120 VAC,	go to Step 7.

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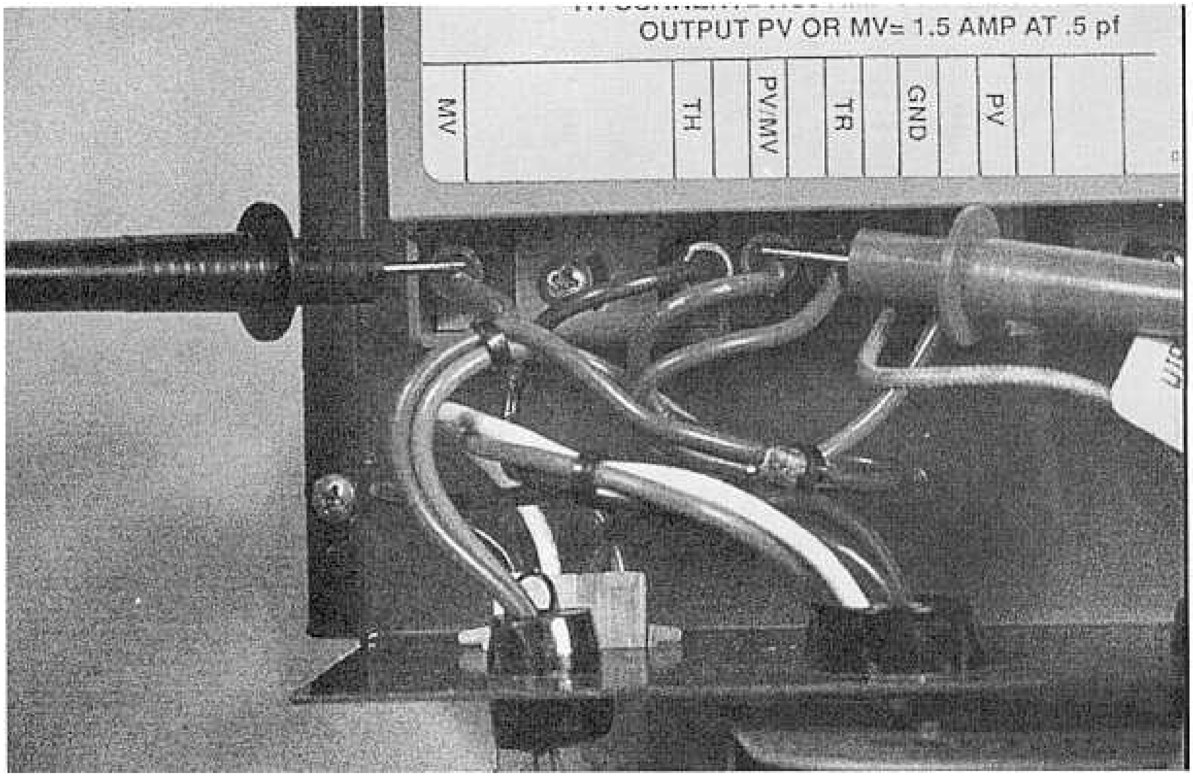
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 7

PV - PV/MV TEST

SET UP THE TEST

- Using a multimeter, test for 24 VAC between PV (pilot valve) and PV/MV on I.I.D. as shown.

- Sparking should stop when pilot is lit. (If sparking does not stop see page 92)

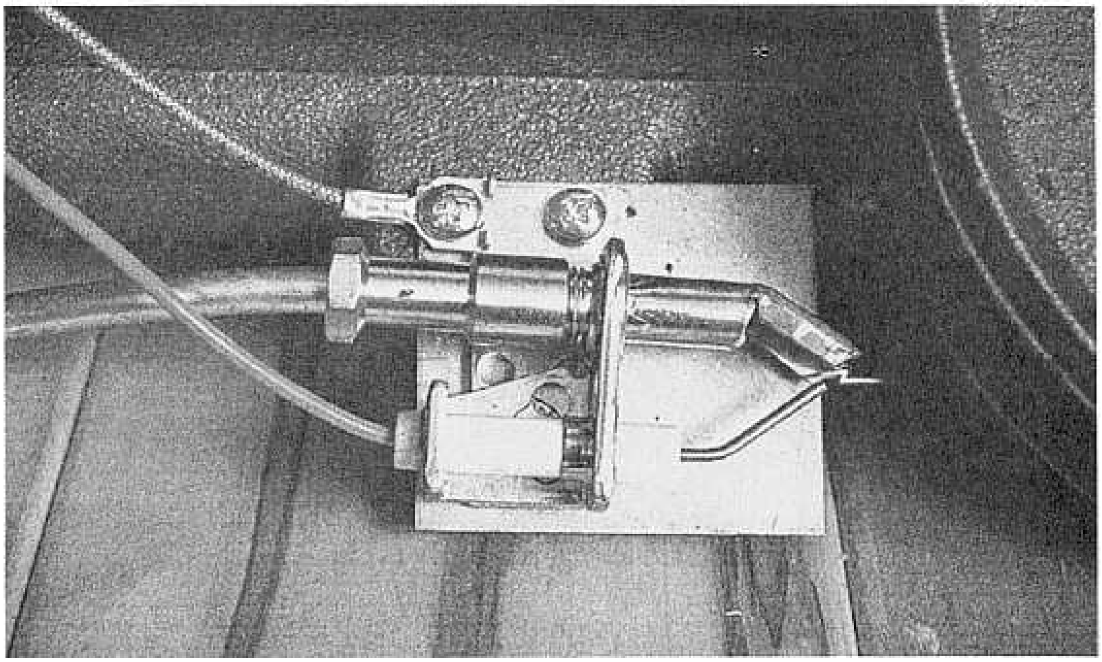
RESULTS

If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 8.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 8	**SPARK TEST**
	SET UP THE TEST - Reset the ON/OFF switch, then - visually check the spark at the pilot assembly. - Sparking should stop when pilot is lit. (If not see page 92)

RESULTS

If:	then:
the electrode is not sparking,	- check 7/64" spark gap between pilot hood and electrode. - check spark cable continuity. - check ground cable continuity at I.I.D.
the electrode is sparking,	go to Step 9.

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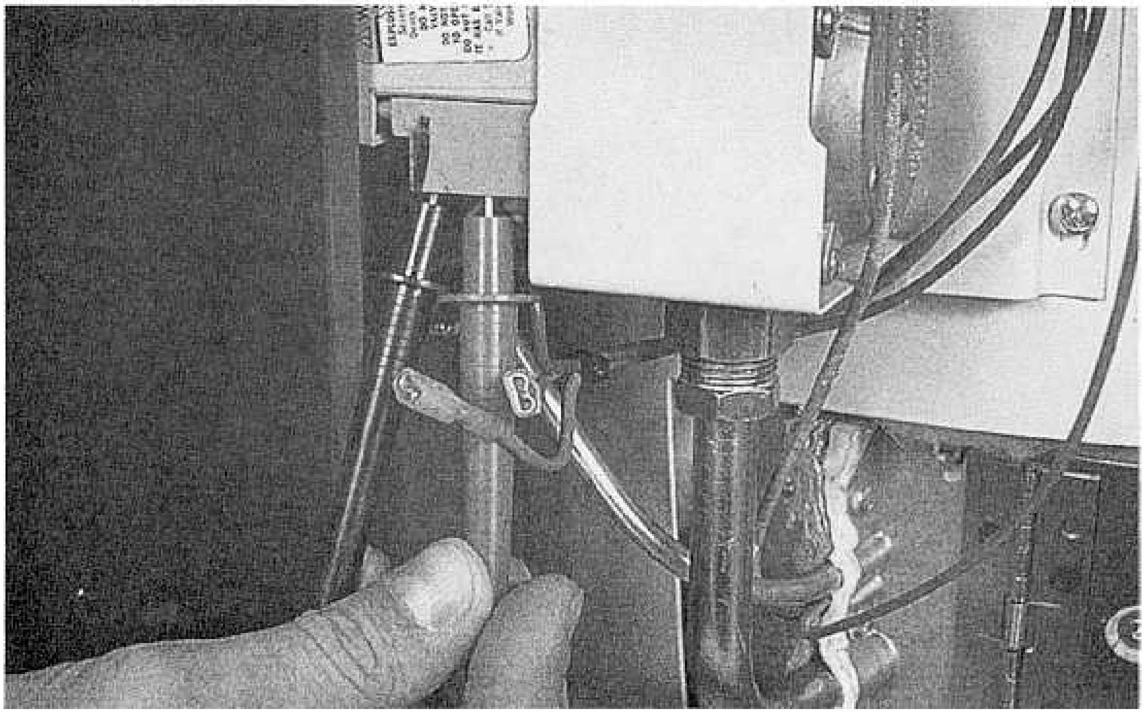
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, no pilot) cont.



STEP 9	PILOT VALVE TEST
	SET UP THE TEST - inspect wire between I.I.D. and pilot valve for lack of continuity or loose connections, correct either of these conditions if necessary, then - disconnect the wire from the pilot valve, then - using a multimeter, test for continuity at pilot valve as shown.

RESULTS

If:	then:
the meter does not read continuity,	replace the valve.
the meter does read continuity,	check the gas supply.

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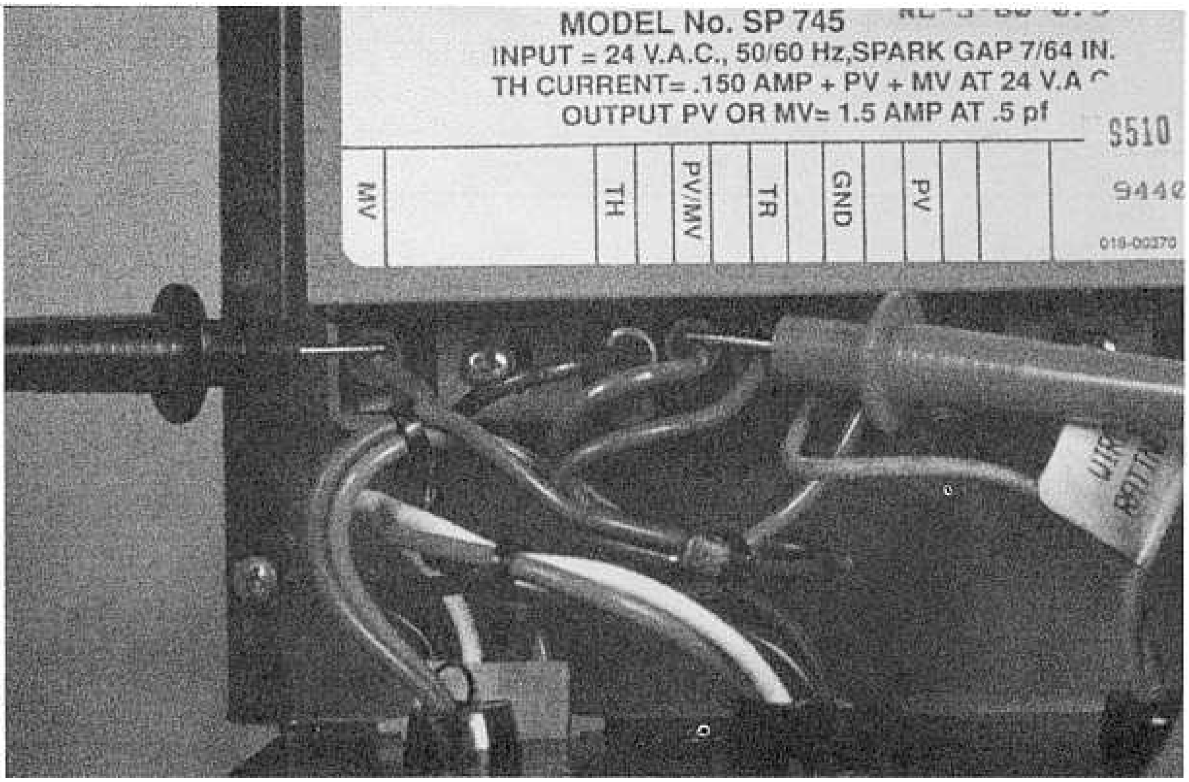
FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.	**BLOWER RUNS CONSTANTLY** (CALLING FOR HEAT, PILOT IS LIT, NO MAIN BURNER) First make the **Preliminary Checks (see page71)** then perform each of the following tests until cause of the failure is determined: **1. MV - MV/PV Test** **2. Main Valve Test**

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.


MODEL No. SP 745
INPUT = 24 V.A.C., 50/60 Hz,SPARK GAP 7/64 IN.
TH CURRENT= .150 AMP + PV + MV AT 24 V.A
OUTPUT PV OR MV= 1.5 AMP AT .5 pf
MV
TH
PV/MV
TR
GND
PV
S510
944
018-00370

STEP 1

MV - PV/MV TEST

SET UP THE TEST

- Using a multimeter, test for 24 VAC between MV and MV/PV on I.I.D. as shown.

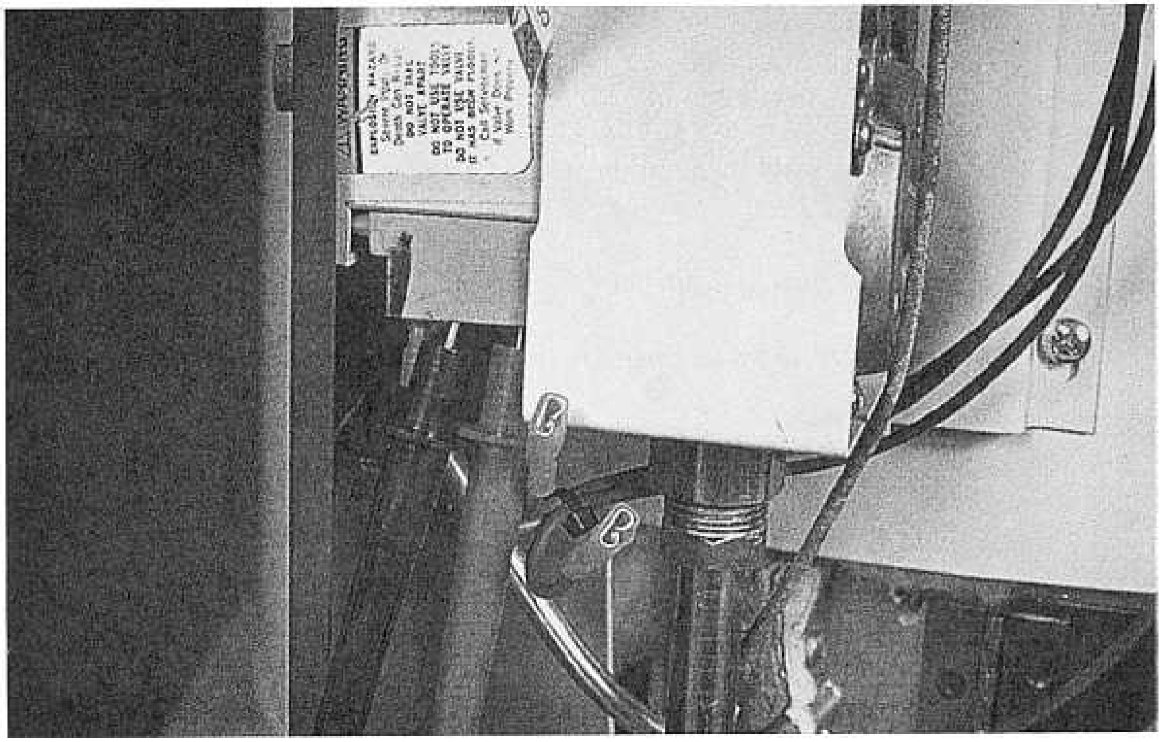
RESULTS

If:	then:
the meter does not read 24 VAC,	replace the I.I.D.
the meter does read 24 VAC,	go to Step 2.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

BLOWER RUNS CONSTANTLY (Calling for heat, pilot is lit, no main burner) cont.



STEP 2

MAIN VALVE TEST

SET UP THE TEST

- inspect wire between I.I.D. and main valve for lack of continuity or loose connections, correct either of these conditions if necessary, then
- using a multimeter, test for continuity on main valve as shown.

RESULTS

If:	then:
the meter does not read continuity,	replace the main valve.
the meter does read continuity,	check gas supply.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

PILOT PROBLEMS

The following are possible causes of pilot problems:

1. An open E.C.O. (high limit) will not allow the heater to relight. (See page 84).
2. Incorrect pilot gas pressure: it should be 3.5" for natural gas and 10" for propane.
3. Excessive equivelant foot length on vents can cause pilot outages.
4. Incorrect pilot position; the pilot should engulf the tip of the flame sensor 3\8" to 1\2".
5. A leak in pilot tube will cause candling.

RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would on any standard residential gas water heater.

FPS 75 SERVICE AND OPERATION cont.

Trouble-shooting cont.

MAIN BURNER PROBLEMS

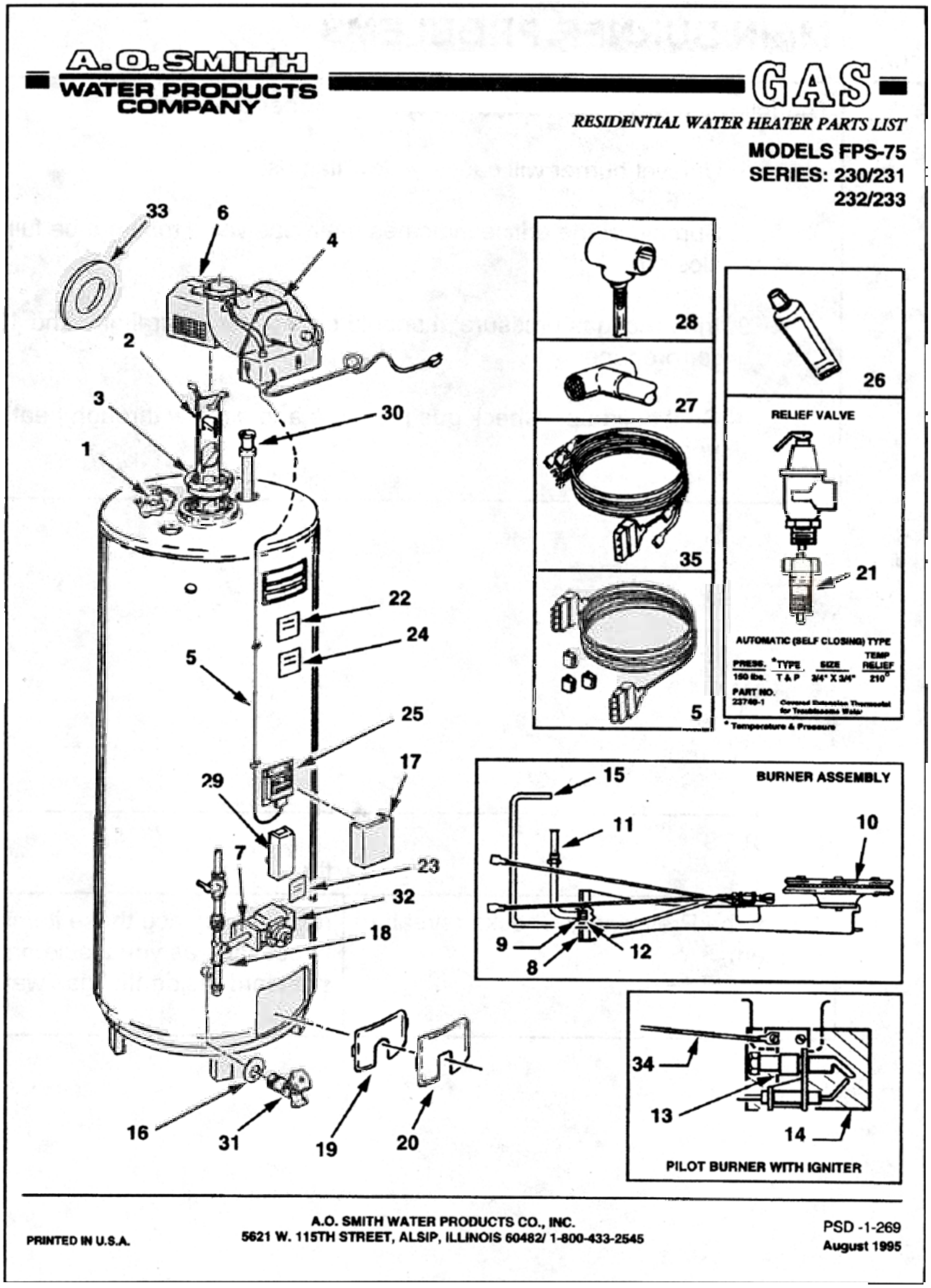
The following are possible causes of main burner problems:

1. Unlevel burner will cause yellow flames.
2. Burning at the orifice indicates main gas valve may not be fully closing.
3. Incorrect gas pressure; it should be 3.5" for natural gas and 10" for propane.
4. Soot build-up. Check gas pressure and air flow through heater and venting.

RESULTS

If:	then:
Any of the Preliminary Checks reveal a problem,	repair or replace these items, if necessary, as you would on any standard residential gas water heater.

FPS 75 PARTS LIST



A.O. SMITH
WATER PRODUCTS
COMPANY

GAS

RESIDENTIAL WATER HEATER PARTS LIST

MODELS FPS-75
SERIES: 230/231
232/233

33
6
4
2
3
30
1
22
24
5
25
17
29
7
23
32
18
16
31
19
20
28
27
35
5
26
21
BURNER ASSEMBLY
15
11
10
9
8
12
34
13
14
PILOT BURNER WITH IGNITER

RELIEF VALVE

AUTOMATIC (SELF CLOSING) TYPE

PRESS.	*TYPE	SIZE	TEMP RELIEF
150 lbs.	T & P	3/4" X 3/4"	210°

PART NO.
23749-1 Covered Extension Thermostat for Troublesome Water

* Temperature & Pressure

PRINTED IN U.S.A.

A.O. SMITH WATER PRODUCTS CO., INC.
5621 W. 115TH STREET, ALSIP, ILLINOIS 60482/ 1-800-433-2545

PSD -1-269
August 1995

FPS-75
SERIES 230/231 THRU 232/233

Item	Description	Part Number
1	Anode	180618-42
	Baffle	
2	Baffle, Flue	182193
3	Flue Restrictor	35405
	Blower	
4	Blower Assembly	182225
5	Blower Wiring Harness	181728-1
6	Fan Housing	182156
7	Bracket, Gas Valve	182179
	Burner	
8	Air Shutter	35376
9	Lock Nut	29001
10	Main Burner	41157-4
11	Main Burner Tube, Nat.	39114-4
11	Main Burner Tube, Prop.	181784-2
12	Orifice, Main Burner, Nat.	29366-21
12	Orifice, Main Burner, Prop.	181778-39
13	Pilot Assembly, Nat.	181954-2
13	Pilot Assembly, Prop.	181954-3
14	Pilot Mounting Plate	192625
15	Pilot Tube	23330
16	Collar, Pipe	20172-6
17	Cover, Control Panel	182181
18	Dirt Leg (Supp. on Prop.	43761
	Door	
19	Inner	39923
20	Outer	39112-1
21	Extender, T&P Valve	43231-1
	Label	
22	Flammable Warning	181139
23	Lighting & Operating	182214
24	Scald Warning	181138
25	Module, Ignition	181723
26	Silicone, High Temp	181564
27	Tee, 3" P.V.C.	181617
28	Tee, Condensate	181861
29	Thermostat w/E.C.O.	182053-1
30	Tube, Inlet	41072
31	Valve, Drain	26273-7
	Valve	
32	Gas, Nat.	182238
32	Gas, Prop.	182239
33	Wall Plate	181557
34	Wire, Ground	77948-9
35	Wire, Harness	182203

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PART INFORMATION

CONTROL	MODELS	SPECIFICATION
Fan	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Draws .75 amp, Turns at 3325 RPM Draws .75 amp, Turns at 3325 RPM Draws 1.8 amp, Turns at 3000 RPM
Air Pressure Switch	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Closes at .3 PSI Closes at .3 PSI Unavailable at this time
Thermostat	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Temperature range no lower limit to 160° Temperature range 110° - 150° Temperature range 120° - 160°
High Limit	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Opens at 195° Opens at 160° Opens at 195°
Gas Valve	FPS40 - 50 FPSE & FPD40 - 50 FPS75	operating pressure - natl. 3.5" w.c., l.p. 10" w.c. operating pressure - natl. 3.5" w.c., l.p. 10" w.c. operating pressure - natl. 3.5" w.c., l.p. 10" w.c.
Pilot	FPS40 - 50 FPSE & FPD40 - 50 FPS75	Standing pilot I.I.D. Draws 1.63 amps I.I.D. Draws 1.63 amps
Gas Pressure Switch	FPS40 - 50	Closes at 2.5" w.c. for natural Closes at 6.5" w.c. for propane
Vent High Limit	FPS75	Opens at 190° closes at 150°
Vent Material	All models	PVC (Class 160, ASTM D-2241; Schedule 40, ASTM D-1785, or Cellular Core Schedule 40 DWV, ASTM F-891), Schedule 40 CPVC (ASTM F-441), or ABS (ASTM D-2661) pipe. The fittings other than the TERMINATION TEE, should be equivalent to PVC_DWV fittings meeting ASTM D-2665 (Use CPVC fittings, ASTM F-438 for CPVC pipe and ABS fittings, ASTM D-2661/3311 for ABS pipe. If CPVC or ABS pipe and fittings are used, then the proper cement must be used for all joints, including joining the pipe to the Termination Tee (PVC Material).

SERVICE CHECKLIST

VI. PROPER SEQUENCE OF OPERATION

A. FPS40 - 50

During standby is blower off?	yes	no
On a call for heat does gas valve open?	yes	no
Does gas pressure switch close?	yes	no
Does the blower come on?	yes	no
If so, does the air pressure make?	yes	no
Does the solenoid open?	yes	no
Does main burner ignite?	yes	no
Does the thermostat satisfy?	yes	no

Comments:____

A. FPSE40 - 50

During standby is blower off?	yes	no
On a call for heat does gas valve open?	yes	no
Does gas pressure switch close?	yes	no
Does the blower come on?	yes	no
If so, does the air pressure make?	yes	no
Does the solenoid open?	yes	no
Does main burner ignite?	yes	no
Does the thermostat satisfy?	yes	no

Comments:____

A. FPD40 - 50

During standby is blower off?	yes	no
On a call for heat does gas valve open?	yes	no
Does gas pressure switch close?	yes	no
Does the blower come on?	yes	no
If so, does the air pressure make?	yes	no
Does the solenoid open?	yes	no
Does main burner ignite?	yes	no
Does the thermostat satisfy?	yes	no

Comments:____

A. FPS75

During standby is blower off?	yes	no
On a call for heat does gas valve open?	yes	no
Does gas pressure switch close?	yes	no
Does the blower come on?	yes	no
If so, does the air pressure make?	yes	no
Does the solenoid open?	yes	no
Does main burner ignite?	yes	no
Does the thermostat satisfy?	yes	no

Comments:____

SERVICE CHECKLIST cont.

VII. SAFETY

A. Gas

Does pilot flame prove before main burner ignites?	yes	no
Does damper blade fully open before ignition sequence occurs?	yes	no
Is burner cover plate in place?	yes	no
Is burner floor shield in place?	yes	no
Does IID lockout occur after 30 sec. trial for ignition? (Propane models only)	yes	no

B. Water Temperature

Is the thermostat adjusted to the lowest acceptable temperature?	yes	no
Does the installation have a mixing valve?	yes	no
If so, is it operational?	yes	no
What is the outlet temperature of the mixing valve?		

NOTE: (Consumer Product Safety Commission advises that water temperature above 130 degrees F. may cause scalding.)

Is a properly rated temperature and pressure relief valve installed?	yes	no

C. Electrical

Is the 120 VAC electrical power supply properly wired?	yes	no
Are all the control covers in place?	yes	no
Is the 120 VAC electrical power supply properly fused?	yes	no

D. Flammables

Are flammable materials located in the area of the water heater?	yes	no
Are flammable vapors located in the area of the water heater?	yes	no

Comments:

QUESTIONS AND ANSWERS

FPS MODELS

Q. What is the CFM of the blower?

A. Maximum of 60 CFM.

Q. Will the blower move more air through the unit than conventional venting and thereby cause less heat to be transferred into the water?

A. No. The unit has been tested to the DOE test methods for recovery efficiency using the minimum and maximum amount of vent piping with the resulting GPH rates as shown on the spec sheet. The baffle and air intakes of the heater still regulate chamber air flow.

Q. Can this unit be vented to a chimney?

A. No. The unit may have condensing flue gases which would attack mortar or standard vent piping.

Q Can I vent the FPS unit vertically?

A. The Series 216 & 217 are sidewall venting only.
The Series 220 and higher can be vented either vertically or horizontally.

Q. Will a snow/riser kit be available?

A. A snow riser kit can be constructed in the field in parts of the country where applicable. The venting should be terminated a minimum of 12 inches above expected snowfall accumulations.

Avoid installations where snow drifting or prevailing wind conditions will interfere with the venting of the heater. Installation of a condensate tee is necessary to prevent condensation from reaching the blower housing.

QUESTIONS AND ANSWERS cont.

Q. Is there a maximum distance that the vent cap can terminate from the exterior wall?

A. No, as long as the overall equivalent length is not exceeded. We would advise that the exterior piping have a slight negative slope and be properly supported and insulated (The colder the vent piping, the more condensation will be experienced).

Q. Can this unit terminate in a window well?

A. No. Clearances to an air inlet opening must be observed.

Q. What is the maximum temperature at which of the sealant will function properly?

A. 400 deg. F

Q. May I paint the vent piping?

A. Yes. Use a latex paint if it will adhere to the smooth surface. Do not use oil based paint, they contain solvents which may attack the PVC.

Q May I use an FPS to replace a Sidewinder?

A. Yes, but the entire FFS unit must be used. Note that the FPV/KPV units use a larger joint penetration hole than is necessary for the FPS. Close the gap by using insulation and a centering plate to center the vent pipe and prevent air drafts into the house.

Q If the vent is blocked, will the blower motor continue to run?

A. Yes, but the air pressure switch will open and interrupt power to the gas solenoid valve shutting off main burner gas flow.

Q. Will increasing the vent pipe size allow a longer equivalent feet run?

A. No, the 3 inch vent is the only sized venting approved.

ADDITIONAL INFORMATION

If the inlet air damper does not open to provide dilution air, the PVC vent will sag due to excessive temperature.

Propane units do not have a bypass in the gas solenoid valve. This may result in occasional cycling stand by between calls for heat. If you experience more than two stand by cycles per hour, consider replacing the main gas control valve.

If hard wiring is required by local codes, use the knockout provided on the blower control box.

For Further Info.	**Contact: A. O. Smith Technical Information Center** **Rochelle Park, Suite 200** **600 E. John Carpenter Freeway** **Irving, Texas 75038**	**Phone:** **1-800-527-1953**

A.O. SMITH

WATER PRODUCTS COMPANY

A DIVISION OF A.O. SMITH CORPORATION

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